Appendix P

Habitat Conservation Plan

for the Properties of

The Pacific Lumber Company,
Scotia Pacific Holding Company,
and Salmon Creek Corporation

January 1999

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GLOSSARY

ABBREVIATIONS

ACD	Angular canopy density
ANOVA	Analysis of variance
BFN	board feet net
C	Celsius
CCC	California Conservation Corps
CCR	California Code of Regulations
CDF	California Department of Forestry and Fire Protection
CDFG	California Department of Fish and Game
CESA	California Endangered Species Act
CEQA	California Environmental Quality Act
CFR	Code of Federal Regulation
CHERT	County of Humboldt Extraction Review Team
CWHR	California Wildlife Habitat Relationships
cm	centimeter(s)
CMZ	channel migration zone
CNPS	California Native Plant Society
COE	(U.S. Army) Corps of Engineers
CPOM	coarse particulate organic matter
DBH	diameter at breast height
DI	disturbance index
DNR	(Washington) Department of Natural Resources
DOM	dissolved organic matter
EEZ	equipment exclusion zone
ELZ	equipment Limitation Zone
EPA	(U.S.) Environmental Protection Agency
ERA	equivalent roaded area
ESA	Endangered Species Act (Federal)
ESU	ecologically significant unit
FEIS	Final Environmental Impact Statement
FEMAT	Forest Ecosystem Management Assessment Team
FPOM	fine particulate organic matter
FPRs	(California) Forest Practice Rules
GIS	Geographic Information System
HCP	habitat conservation plan
ITP	incidental take permit
LEB	limited entry band
LMZ	limited management zone
LOP	(COE) Letter of Permission
LTO	licensed timber operator
LTSY	long-term sustained yield

LWD	large woody debris
m	meter(s)
MBFN	thousand board feet net
mm	millimeter(s)
MMCA	marbled murrelet conservation area (also "MCA" in some reports)
MWAT	maximum weekly average temperature
NCASI	National Council for Air and Stream Improvement
NCRWQCB	North Coast Regional Water Quality Control Board
NEPA	National Environmental Policy Act
NMFS	National Marine Fisheries Service
NSO	northern spotted owl
OB	outer band
POM	particulate organic matter
PWA	Pacific Watershed Associates
RHB	restricted harvest band
RMZ	riparian management zone
RPF	registered professional forester
RWQCB	Regional Water Quality Control Board
SEB	selective entry zone
SYP	Sustained Yield Plan
THP	Timber Harvesting Plan
USFWS	U.S. Fish and Wildlife Service
WAA	watershed assessment area
WLPZ	Watercourse and Lake Protection Zone

DEFINITIONS

Aggradation: Deposition in one place of material eroded from another. Aggradation raises the elevation of streambeds, floodplains, and the bottoms of other water bodies.

Anadromous: Moving from sea to fresh water for reproduction.

Bankfull width: Channel width between the tops of the most pronounced banks on either side of a stream reach.

Boulders: Substrate particles greater than 256 mm in diameter. Often subclassified as small (256-1,024 mm) and large (>1,024 mm) boulders.

Cable Yarding: The system of transporting logs (typically used with ground-based equipment, e.g., tractor, rubber tire skidder, et.) by means of cable (wire rope) to the yarding machine (yarder) or a landing while the yarder remains stationary.

Canopy Closure: The proportion of an area covered by tree crowns.

Canopy Cover: Vegetation projecting over waters, including crown cover (generally more than 1 m above the water surface) and overhead cover (less than 1 m above the water).

Channel: Natural or artificial waterway of perceptible extent that periodically or continuously contains moving water.

Channel Migration Zone: The boundary generally corresponds to the modern floodplain, but may also include river terraces that are subject to significant bank erosion. The area adjacent to watercourses constructed by the river in the present climate and inundated during periods of high flow. The floodplain is delineated by either the flood-prone area (twice bankfull depth) or the 100-year floodplain, whichever is greater.

Class I Waters: Fish are always or seasonally present onsite, includes habitat to sustain fish migration, spawning, and rearing. Also includes domestic water supplies, such as springs, on site or within 100 ft. downstream the project operations area.

Class II Waters: Non-fish bearing waters, where aquatic habitat is present for non-fish aquatic species, including in watercourses, streams, seeps, springs, lakes, ponds and wetlands.

Class III Waters: No aquatic life or habitat present. Showing evidence of being capable of sediment transport to Class I and Class II waters under normal high water flow conditions before or after completion of timber operations.

Closed Road: A proactive method of closing a road so that regular maintenance is no longer needed and future erosion is largely prevented. The goal of road closure is to leave the road so that little or no maintenance is required for stability while the road is unused. Closed roads usually involve erosion-proofing techniques including removing stream crossing fills and culverts, removing unstable road and landing fills, installing cross road drains (e.g., rolling dips and water bars) for permanent road surface drainage and other erosion prevention and erosion control measures as needed. Properly road closure is not accomplished by blocking a road and walking away from it to let "nature reclaim the road".

Cobble: Substrate particles 64-256 mm in diameter. Often subclassified as small (64-128 mm) and large (128-256) cobble.

Commercial Thinning: The removal of trees in a young-growth stand to maintain or increase average stand diameter of the residual trees, promote timber growth and improve forest health. The residual stand consists primarily of healthy vigorous dominant and codominant trees from the preharvest stand.

Conservation: As defined in the federal Endangered Species Act, the use of all methods and procedures which are necessary to bring any endangered or threatened species to the point at which the measures provided pursuant to the Act are no longer necessary; such measures and procedures include, but are not limited to, all activities associated with scientific resource management such as research, census, law enforcement, habitat acquisition and management, propagation, live trapping and transportation, and in rare cases, regulated taking (ESA, Section 3[3]).

Critical Habitat: Defined in the federal Endangered Species Act (1973) to include the area occupied by a species at the time it is listed, specific areas in the vicinity of the occupied habitat, and specific areas away from the occupied habitat considered essential for the conservation of the species.

Culvert: Buried pipe structure that allows streamflow or road drainage to pass under a road.

Cumulative Impact: The incremental environmental impact of an action together with impacts of past, present, and reasonably foreseeable actions (regardless of the source of the other actions).

Decommissioned Road: To remove those elements of a road that unnaturally reroute hillslope drainage or present slope stability hazards. To return a road prism back to its natural hillslope contours.

Degradation: Erosional removal of materials from one place to another within a watercourse. Degradation lowers the elevation of streambeds and flood plains.

Drainage Area (Watershed): Total land area draining to any point in a stream, as measured on a map, aerial photo, or other horizontal, two-dimensional projection.

Equipment Exclusion Zone: (EEZ) The area where heavy equipment associated with timber operations is totally excluded for the protection of aquatic habitat, aquatic species, water quality, beneficial uses of water and other forest resources.

Embeddedness: Degree to which large particles (boulders, rubble, gravel) are surrounded or covered by fine sediment, usually measured in classes according to percent coverage.

Emergency Timber Operations: Defined in the 1998 California Forest Practice Rules, Subchapter 7, Article 2, section 1052, subsections 1052.1, 1052.2, and 1052.3.

Endangered Species: Any plant or animal species in danger of extinction in all or a significant part of its range.

Endangered Species Act: Federal act of 1973, as amended, 16 U.S.C. Sections 1531 - 1543; California act of 1984, as amended, Fish and Game Codes Sections 2050-2098.

Exemption Harvest: Defined in the 1998 California Forest Practice Rules, Subchapter 7, Article 2, section 1038.

Extinct: Species lacking a living representative; species which no longer exists in its original form.

Fine Sediments: Sediment with particle sizes of 2 mm and less, including salt, silt, and clay.

Fry: Life stage of trout and salmon between full absorption of the yolk sac and a somewhat arbitrarily defined fingerling or parr stage (generally reached by the end of the first summer).

Gradient: Average change in vertical elevation per unit of horizontal distance.

Gravel: Substrate particles between 2 and 64 mm in diameter.

Habitat Conservation Plan (HCP): A plan which describes expected impacts and conservation measures to minimize and mitigate those impacts on fish and wildlife species; required as part of a Section 10(a)(1)(B) incidental take permit application under the federal Endangered Species Act.

Harass: A form of take under the federal ESA; defined in federal regulations as an intentional or negligent act or omission which creates the likelihood of injury to wildlife by annoying it to such an extent as to significantly disrupt normal behavioral patterns which include, but are not limited to, breeding, feeding, or sheltering (50 CFR 17.3).

Harm: A form of take under the federal ESA; defined in federal regulations as an act which actually kills or injures wildlife. Such acts may include significant habitat modification or degradation where it actually kills wildlife by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering (50 CFR 17.3).

Headwall Swale: A concave depression, with convergent slopes typically of 65% or greater that is connected to a waters via a continuous linear depression. A linear depression interrupted by a landslide deposit is considered continuous for this definition.

Hydrologic Unit: Contains all areas that drain into a single basin. Larger than an individual planning watershed, but smaller than a Watershed Analysis Area. Refer to Figure 3. Not

to be confused with the State of California Regional Water Quality Control Board Hydrologic Units.

Improperly Abandoned Road: A road that is no longer in use and was walked away from to let "nature reclaim". The road has not been erosion-proofed and is not maintained, but may be blocked from access by a gate, berm, or road failure.

Incidental Take: The taking of a federally or state listed species, if such taking is incidental to, and not the purpose of, carrying out otherwise lawful activities.

Large Woody Debris (LWD): Any large piece of woody material that is within the bankfull width or channel migration zone of a watercourse, whose smallest diameter is greater than 10 cm and whose length is greater than 1 m.

Mass Wasting Areas of Concern: A combination of all areas defined as inner gorges, headwall swales, unstable areas, and areas of high, very high and extreme mass wasting hazard potential.

Mitigation: Measures undertaken to diminish or compensate for the negative impacts of a project or activity on the environment, including (a) avoiding the impact altogether by not taking a certain action or parts of an action; (b) minimizing impacts by limiting the degree or magnitude of the action and its implementation; (c) rectifying the impact by repairing, rehabilitating, or restoring the affected environment; (d) reducing or eliminating the impact over time by preservation and maintenance operations during the life of the action; or (e) compensating for the impact by replacing or providing substitute resources or environments.

Monitoring: The process of collecting information to assess and document implementation and effectiveness of mitigation measures and to evaluate whether or not the objectives of the habitat conservation plan are being realized.

No Harvest Band: The first band of the Class I (0' – 100'), Class II, (0' – 30') and Class III (0' – 30') RMZs prior to watershed analysis. No timber harvest is allowed in this band, including sanitation salvage, exemption harvest and emergency timber operations.

Outer Band: The second band (100' - 170') of the RMZ on Class I waters. Under certain circumstances, selected harvest can occur in this band**.**

Parr: Young salmonid, in the stage between alevin and smolt, that has developed distinctive dark "parr marks" on its sides and is actively feeding in fresh water.

Planning Watershed: The contiguous land base and associated watershed system that forms a fourth order or other watershed typically 10,000 acres or less in size. CDF has prepared and distributed maps identifying the planning watersheds.

Pool: Portion of a stream with reduced current velocity, often with deeper water than surrounding areas and with a smooth surface.

Population: A collection of individuals that share a common gene pool.

Reconstructed Road: Those existing roads that are to be restored or improved to make useable for hauling forest products. Reconstructed does not include routine or annual maintenance or rehabilitation that does not require substantial change in the original prism of the road.

Redd: Nest made in gravel, consisting of a depression hydraulically dug by a fish for egg deposition and associated gravel mounds.

Registered Professional Forester (RPF): A person who holds a valid license as a professional forester pursuant to Article 3, Section 2, Division 1 of the California Public Resources Code.

Riparian Management Zone: The area on either side of Class I, Class II, or Class III waters that receives special treatments. May refer to any combination of the following: No Harvest Band, Selective Entry Band, Outer Band and/or Sediment Filtration Band.

Riparian Vegetation: Vegetation growing on or near the banks of a stream or other body of water in soils that exhibit some wetness characteristics during some portion of the growing season.

Run (fish): A group of fish migrating in a river (most often on a spawning migration) that may comprise one or many stocks.

Salmonids: Fish of the family Salmonidae, including salmon, trout, chars, whitefish, ciscoes, and grayling.

Sand: Substrate particles 0.061-2 mm in diameter.

Sanitation Salvage: Sanitation is the removal of insect attacked or diseased trees in order to maintain or improve the health of the stand. Salvage is the removal of only those trees which are dead, dying, or deteriorating, because damage from fire, wind, insects, disease, flood or other injurious agent. Sanitation and salvage may be combined into a single operation and for the purposes of this Plan are considered the same operation.

Section 7: The section of the federal Endangered Species Act codified at 16 USC § 1536, that provides for consultation between federal agencies and the U.S. Fish and Wildlife Service to ensure that any action authorized, funded, or carried out by such agencies is not likely to jeopardize the continued existence of any endangered or threatened species or result in the destruction or adverse modification of critical habitat of such species.

Section 9: The section of the federal Endangered Species Act codified at 16 USC § 1538, that prohibits the "taking" of any listed species.

Section 10(a): The section of the federal Endangered Species Act codified at 16 USC § 1539(a), that allows takings of a listed species for scientific purposes and taking incidental to otherwise lawful activities subject to approval of the Department of Interior or Department of Commerce as appropriate; both types of take require permits.

Section 2080: The section of the California Endangered Species Act that prohibits the "taking" of endangered and threatened species listed by the California Fish and Game Commission and species that the Commission has elevated to the status of candidates for such listing.

Section 2081, Section 2081 Permit: The section of the California Endangered Species Act that authorizes the California Department of Fish and Game to permit take of state listed species for scientific purposes and to enter into memoranda of understanding with persons, institutions, and agencies for the management of state listed species.

Section 2090, Section 2090 Consultation: The section of the California Endangered Species Act that requires all state lead agencies to consult with the California Department of Fish and Game regarding projects with impacts to state listed species; requires a written statement from the Department regarding whether or not the project will jeopardize the continued existence of the species.

Sediment: Fragments of rock, soil, and organic material transported and deposited in beds by wind, water, or other natural phenomena.

Sediment Filtration Band: The second band (30' – 50' or 100', respectively) in the Class III RMZs. Timber harvest is allowed in this band.

Sedimentation: Deposition of material suspended in water or air, usually when the velocity of the transporting medium drops below the level at which the material can be supported.

Selective Entry Band: The second band (30' – 130') in Class II RMZs. Under certain circumstances, selected timber harvest can occur in this band.

Sensitive Species: Here, a category of species designated for special protection by the California Board of Forestry.

Silt: Substrate particles 0.004-0.062 mm in diameter.

Slash: Branches or limbs less than four inches in diameter, and bark and split products debris left on the ground as a result of timber operations (Z'berg-Nejedly Forest Practice Act of 1973).

Snag: A standing dead tree.

Species: Any distinct population of wildlife that interbreeds when mature.

Stream: A natural watercourse as designated by a solid line or dash and three dots symbol shown on the largest scale United States Geological Survey map most recently published (Z'berg-Nejedly Forest Practice Act of 1973).

Stream Order: A number from 1 to 6 or higher, ranked from headwaters to river terminus, that designates the relative position of a stream or stream segment in a drainage basin. First order streams have no discrete tributaries; the junction of two first order streams produces a second order stream; the junction of two second order streams produces a third order stream; etc.

Substrate: Mineral or organic material that forms the bed of a stream.

Suspended Sediment: That part of a water's total sediment load carried in the water column.

Take: As defined in the federal Endangered Species Act, to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect a threatened or endangered species, or attempt to do so. See also "harm" and "harass."

Thalweg: The deepest point of a watercourse along any channel cross section.

Threatened Species: Any species or subspecies that is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range.

Timber Harvesting Plan (THP): A three-year plan for the harvesting of commercial timberlands that (1) must be prepared by a registered professional forester, (2) must be filed with and approved by the California Department of Forestry, and (3) must contain detailed information about the land to be harvested, the silviculture methods to be applied, special provisions (if any) to protect unique and sensitive resources in the area, the dates when timber operations will commence and conclude, and any other information that may be required by the State Board of Forestry.

Timberland: Land, other than land owned by the federal government, and land designated by the California Board of Forestry as experimental forest land, which is available for, and capable of, growing a crop of trees of any commercial species used to produce lumber and other forest products, including Christmas trees. Commercial species are determined by the State board on a district basis. (Z'berg-Nejedly Forest Practice Act of 1973)

Timber Operations: The cutting or removal of timber or other solid wood forest products, including Christmas trees, from timberlands for commercial purposes, together with all the

work incidental thereto, including, but not limited to, construction and maintenance of roads, fuelbreaks, firebreaks, stream crossings, landings, skid trails, beds for the falling of trees, and fire hazard abatement, but excluding preparatory work such as tree marking, surveying, or road flagging (Z'berg-Nejedly Forest Practice Act of 1973).

Unstable Area: Characterized by slide areas or by some or all of the following: hummocky topography consisting of rolling bumpy ground, frequent benches, and depressions; short irregular surface drainages begin and end on the slope; tension cracks and headwall scarps; slopes that are irregular and may be slightly concave in the upper half and convex in the lower half from previous slope failure; evidence of impaired ground water movement resulting in local zones of saturation within the soil mass which is indicated at the surface by sag ponds with standing water, springs or patches of wet ground. Some or all of the following may be present: hydrophytic vegetation prevalent; leaning, jackstrawed or split trees are common; pistol butted trees with excessive sweep may occur in areas of hummocky topography (leaning trees should be used as indicators of unstable areas only in the presence of other indicators.

Watercourse: Any well defined channel with distinguishable bed and bank showing evidence of having contained flowing water indicated by deposit of rock, sand, gravel, or soil, including but not limited to streams.

Waters: Includes streams, watercourses, seeps, springs, lakes, ponds and wetlands.

Watercourse or Lake Transition Line: That line closest to the watercourse or lake where riparian vegetation is permanently established. Willows are not considered permanent vegetation.

Watershed: see "Drainage Area."

Wildlife Agencies: United States Fish and Wildlife Service (USFWS); National Marine Fisheries Service (NMFS); and California Department of Fish and Game (CDFG)

Wildlife Habitat Relationships (WHR) System: A vegetation classification system that is correlated to a computer model developed to evaluate the characteristics of forest and other habitat types in California with the habitat requirements of birds, mammals, reptiles and amphibians species.

Yarding: Movement of timber from the point of felling to a yarder, road, or landing.

A. ORGANIZATION

This Habitat Conservation Plan (HCP or Plan) is the HCP prepared in response to the requirements of the federal Endangered Species Act (FESA) and California Fish and Game Code (FGC). This document includes the HCP elements required by the FESA. The HCP elements covered in this document includes impacts to the covered species, the operating conservation program including minimization, mitigation, and monitoring measures, alternatives considered, Plan funding, and other measures.

B. PLANNING CONTEXT

Preparation of this Plan has been guided by:

- Species protection requirements, incidental take provisions, and other sections of the FESA and California FGC (including but not limited to the California Endangered Species Act (CESA);
- The agreement reached in September 1996 regarding the transfer of approximately 5,600 acres of PALCO property to the United States of America and State of California (Headwaters Agreement); and
- The Pre-permit Application Agreement in Principle reached in February 1998 regarding components and completion of this Plan and interim measures to be implemented by PALCO (Agreement in Principle).
- The Draft SYP/HCP and public comments.

1. HCP CONSIDERATIONS

Consistent with the objectives of the FESA and California FGC, the Plan is a long-term comprehensive program to ensure the continued health of the biological communities on PALCO's property and to minimize and mitigate impacts of PALCO activities on individual species. In this regard, the Plan has both a multi-species and habitat focus; it also has a specific legal purpose with regard to impacts to species and habitats.

Similar to other habitat-based multi-species HCPs (e.g., Plum Creek and plans approved in southern California under the NCCP program), this Plan was developed by focusing on the requirements of selected species (Focus Species) while also addressing the needs of other species in the same habitat. This tiered approach is an essential feature of the Plan's terrestrial and aquatic conservation strategies. Marbled murrelet (*Brachyramphus marmoratus*) and northern spotted owl (*Strix occidentalis caurina*) are the Focus Species for the terrestrial strategy, and the measures for these two birds are designed to benefit a broad range of other species in PALCO's managed forests. Some measures, such as the establishment of marbled murrelet conservation areas (MMCAs), preserve and protect Focus and other species in specific locations. Other measures, such as maintaining a mix of seral types across the landscape and retaining structural components of wildlife habitat, benefit Focus and other species by sustaining important features of the larger ecosystem. The Plan's aquatic habitat conservation strategy functions in a similar way. In this case, the Focus Species are four fish (coho salmon, *Oncorhynchus kisutch*; chinook salmon, *Oncorhynchus tshawytscha*; cutthroat trout, *Oncorhynchus clarki*, and steelhead trout,

Oncorhynchus mykiss). Measures for these species focus on habitat conditions in fish-bearing streams and extend outward to encompass riparian zones and entire watersheds.

By providing for unlisted as well as listed species, the tiered approach of the conservation strategies also is important to the legal purposes of the Plan. As described in Part A of Volume V, of the July 1998 Draft SYP/HCP a primary purpose of the Plan is to provide the basis for U.S. Fish and Wildlife Service (USFWS), National Marine Fisheries Service (NMFS), and California Department of Fish and Game (CDFG) to authorize incidental take of certain listed species, including some species that currently are not but may be listed during the life of the Plan. Specifically, PALCO is seeking authorization for incidental take from USFWS and NMFS pursuant to Section 10(a) of the FESA and from CDFG pursuant to Sections 2081 of the FGC. For purposes of the ITPs, the Plan:

1. Identifies the species that would be covered by the permits (Covered Species);
2. Treats unlisted Covered Species as if they were listed;
3. Identifies alternatives to the taking and the reasons why the alternatives were not employed;
4. Examines the impacts of the proposed take on the species;
5. Identifies measures to minimize and mitigate impacts;
6. Includes provisions for responding to changed and unforeseen circumstances;
7. Provides assurances that adequate funding is available for implementation; and
8. Provides assurances that the Plan will be implemented.

In connection with ongoing timber operations and implementation of the Plan, PALCO also is seeking a five-year renewable Streambed Alteration Agreement with CDFG pursuant to Section 1603 of the FGC. For purposes of the 1603 agreement, the Plan identifies PALCO Plan Area activities with the potential to alter streams and riparian areas under CDFG's jurisdiction and substantially adversely affect fish and wildlife resources. The 1603 Agreement identifies measures for certain of these PALCO Plan Area activities that are covered under the 1603 Agreement that PALCO will implement to avoid, minimize, and mitigate such impacts. This Plan is the HCP submitted with PALCO's ITP applications to USFWS and NMFS and the information and analysis required by CDFG for its consideration of incidental take authorization.

2. HEADWATERS AGREEMENT

The September 1996 Headwaters Agreement (see Volume V of the July 1998 Draft HCP for copy) contemplates government acquisition of timberlands from PALCO and another landowner for the purpose of preserving approximately 7,500 acres of old growth, and young growth timber stands, and associated buffers in a nature reserve. As proposed, PALCO would transfer ownership of two unentered old-growth timber stands and associated buffers (i.e., PALCO's Headwaters and Elk Head Springs timber stands) to the state and federal governments. PALCO also has voluntarily agreed to refrain from logging activities (including salvage logging) in the specified stands pending

the development of this Plan. In exchange for the transferred lands, PALCO would receive approximately 7,700 acres of previously harvested timberlands and other consideration (including cash) with an aggregate value of $300 million. Among other things, the Headwaters Agreement conditions the transactions on PALCO's dismissal of pending lawsuits alleging that the state and federal governments have taken PALCO's property in violation of the state and federal constitutions, and on completion and approval of an SYP and HCP for PALCO's property acceptable to PALCO. The transactions also are expressly conditioned on compliance with applicable law, including the National Environmental Policy Act (NEPA) and California Environmental Quality Act (CEQA). This Plan is the HCP cited in the September 1996 Headwaters Agreement.

3. AGREEMENT IN PRINCIPLE

The February 1998 Agreement in Principle (see July 1998 Draft SYP/HCP, Volume V for copy) established a framework for the development of the Draft SYP/HCP. It defined certain components of PALCO's ITP applications, addressed procedures for completion of the July 1998 Draft SYP/HCP, and provided for PALCO's implementation of certain conservation measures in the interim. Among other provisions, the agreement:

- Indicates that PALCO will apply for ITPs that cover 50 years;
- Identifies PALCO lands in addition to the Headwaters and Elk Head Springs stands that will be conserved for the marbled murrelet and other species; and
- States PALCO's commitments regarding implementation of specific stream-related measures in pending Timber Harvesting Plans (THPs) prior to issuance of the ITPs and inclusion of those measures in the July 1998 Draft SYP/HCP.

The Agreement in Principle did not provide any advance approval of the SYP/HCP by the responsible agencies; and, as with the Headwaters transactions, approval and implementation of this Plan is subject to all applicable laws, including NEPA and CEQA.

C. SCOPE OF THE PLAN

1. PLAN AND PERMIT AREA

The Plan Area for this HCP is defined as PALCO's ownership as it is anticipated to exist on and following the effective date of the ITPs. As shown in the July 1998 Draft SYP/HCP, Map 2 in Volume IV, which is hereby incorporated by reference, the initial Plan Area will include approximately 211,700 acres in Humboldt County, California. Except as noted below, the area covered by the ITPs is the same as the Plan Area. Over time, it is anticipated that additional lands will become part of the Plan Area, be subject to the provisions of the Plan, and, with certain exceptions, be covered by the ITPs. It also is anticipated that over time some lands in the Plan Area may be transferred to other owners through land trades and sales. The Implementation Agreement (IA) for this Plan includes provisions for such additions and deletions (see copy of IA in Appendix S). See Table 1.

2. PLAN AND PERMIT PERIOD

The term of the ITPs that PALCO is seeking is 50 years.

3. COVERED SPECIES

For SYP as well as HCP purposes, listed and a select list of sensitive species potentially affected by activities in the Plan Area have been identified as covered species below for which PALCO is seeking ITPs. PALCO may seek to amend the Plan and ITPs in the future to include one or more other species.

The covered species under this Plan are: the marbled murrelet, northern spotted owl, chinook salmon, coho salmon, cutthroat trout, steelhead, southern torrent salamander, tailed frog, red-legged frog, foothill yellow-legged frog, northwestern pond turtle, bald eagle, American peregrine falcon, western snowy plover, bank swallow, Pacific fisher, and California red tree vole. Refer to Table 2.

4. COVERED ACTIVITIES

Subject to the conditions and restrictions identified in this Plan and specified in the ITPs, activities covered by the authorizations for incidental take include:

a. Timber Management

Timber management is the primary activity in the Plan Area, occurring on approximately 203,000 acres. Management activities include timber harvest and regeneration, site preparation, planting, vegetation management, thinning, and fire suppression.

1) Timber Harvesting and Regeneration Methods

Before a forest stand can be harvested, a Registered Professional Forester (RPF) must prepare a THP. The THP is reviewed by state and, in some cases, federal agencies for consistency with all applicable laws and regulations to ensure that potentially significant environmental impacts are analyzed and fully mitigated to the extent feasible. This requirement has applied to commercial timber operations in California since 1973 (see July 1998 Draft SYP/HCP, Part A in Volume V for additional details).

In the Plan Area, even-aged and uneven-aged silvicultural prescriptions will be used. Even-aged silviculture is used to regenerate a stand of trees approximately the same age. This objective is achieved by harvesting stands in blocks that typically range in size from 20 to 30 acres. Harvest methods include seed tree removal, shelterwood removal, and clearcutting. Regeneration occurs artificially through the planting of nursery-grown seedlings, or naturally by well-distributed seed trees. Uneven-aged silviculture is used to harvest trees individually or in small groups, with the goal of developing or maintaining a variety of age classes within a stand. Typically, sites are restocked through natural regeneration; where necessary, seedlings obtained from a nursery also

are used. Harvesting operations begin with the felling and bucking of trees. Logs are moved (yarded) to a landing site using methods determined based on topographic considerations, access, worker safety, and other factors. Generally, tractor-based systems are used on relatively mild terrain, cable yarders are used on steeper slopes, and helicopters are used in areas where road access is a problem. At the landings, the logs are loaded onto trucks and transported to processing facilities (mills) over private and public roads.

2) Site Preparation

Depending on site conditions, excessive amounts of slash (mostly branches from trees) and unwanted shrub and tree species are removed. This is typically accomplished by a broadcast burn or, less commonly, mechanical methods. This treatment only applies to clearcut sites where excessive quantities of slash prevent tree planters from successfully planting trees uniformly throughout the harvest unit. The treatment also has the additional benefit of reducing the potential for wildfire to ignite or spread through the site. Broadcast burning permits must be obtained from CDF and the regional air quality board. If needed, fire trails are constructed to protect resources at risk (e.g., riparian habitat adjacent to a stream). Personnel are located on-site to monitor the burn and to take action in the event of an escape.

3) Planting

Artificial regeneration is principally used to ensure that stocking requirements specified in the California Forest Practice Rules (FPRs) are met. The usual practice is to plant seedlings in those areas that have been clearcut. Seedlings are purchased from a variety of vendors and selected to fit the environmental conditions of site where they will be planted.

4) Thinning

Overstocked even-aged stands will be thinned, where appropriate, to redistribute the growth potential of the site to fewer conifer trees. When such an operation occurs in a very young stand (approximately 15 years old), it is called precommercial thinning. Stems are cut down and left on the site to decay. Commercial thinning requires preparation of a THP and may occur as early as 35 years. Leave trees (i.e., the trees that will be retained) are selected to ensure that they are evenly distributed throughout the site and have the potential to take advantage of the increased growing space. The harvested trees are yarded to a landing, loaded onto trucks, and transported to a processing facility.

5) Fire Suppression

In response to wildfires, activities similar to those used for escaped control burns are used to minimize the total number of affected acres. These activities will be covered by the ITPs and, under this Plan, fire management plans will be prepared for the MMCAs.

b. Roads and Landings

Activities for the maintenance, improvement, construction, and closure of roads and landings include:

1. Implementation of PALCO's storm-proofing program;

2. Construction of new roads in connection with timber management, including clearing vegetation from road rights-of-way, removing trees, grubbing (removing stumps and surface organics), grading, and compaction;

3. Extraction of rock, sand, and gravel from small borrow pits for use in road construction and maintenance, drainage facility repair, and erosion control;

4. Construction of stream crossings (bridges, culverted fills, fords, and a variety of temporary crossings);

5. Maintenance of surfaced roads, seasonal roads, culverts, bridges, fords, cuts and fillslopes; and

6. Closure of roads, temporarily (i.e., decommissioned) or permanently (i.e., abandoned).

Approximately 150 miles of new roads will be added in the Plan Area in the first decade of Plan implementation; 100 miles in the second decade, 75 miles in the third decade, 50 miles in the fourth decade, and 25 miles in the fifth decade. At least 750 miles of existing roads will be storm-proofed per decade within the first 20 years until all roads on the property have been brought up to that standard.

Additional details regarding road-related activities are provided in the Guidelines for Forest Roads and Landings (July 1998 Draft SYP/HCP, Part N of Volume II).

c. Commercial Rock Quarries

PALCO operates two permitted commercial hard rock quarries in the Plan Area. The two commercial quarries are identified as Rock Quarry 1/Road 24 and Rock Quarry 2/Road 9.

- Rock Quarry 1/Road 24 is located in the Yager Creek drainage, approximately five miles upstream from Carlotta, California. The approved Humboldt County conditional use permit and the approved mining and reclamation plan for the quarry provide for a total production of approximately 125,000 cubic yards of aggregate material. The entire quarry site includes approximately 3.5 acres.
- Rock Quarry 2/Road 9 is located in the Lawrence Creek drainage of the Yager Creek watershed. It was operated for many years for in-house use only and, following approval of the conditional use permit, is mined for commercial purposes. The volume of available material in Quarry 2 is estimated at approximately 450,000 cubic yards.

These two existing quarry operations will be covered by the ITPs for two years.

Coverage for these operations beyond the two years period and coverage for any additional quarry sites proposed by PALCO will require amendments to the ITPs and Plan.

Quarry operations involve excavation, drilling, blasting, screening, loading and hauling, and activities ancillary to the quarry operation include road relocation, erosion control, annual closure, and final reclamation. Materials are hauled off-site and transported by truck or rail to their ultimate destination for use as slope stabilization, bedding, and road base. Operations are seasonal, with most mining occurring from April through November. Minor quarrying may occur from December through March in response to local demand for material or the need to provide material for erosion

control or road storm-proofing activity. Additional information about the quarries is provided in July 1998 Draft SYP/HCP, Part J of Volume II.

PALCO also uses many small sand or rock sources (borrow pits) in the Plan Area for road maintenance, drainage facility repair, and erosion control. Because of their small size and minor impacts, these borrow pits do not require permits under federal or state regulations and are not mapped or inventoried. Activities associated with these borrow pits are part of PALCO's road and sediment control program and are covered by the ITPs for a period of 5 years after the effective date. Coverage for borrow pits beyond the five year period will require an amendment to the ITPs.

D. BASELINE CONDITIONS

A description of baseline conditions is presented in the EIS/EIR for this project. Refer to Tables at the end of this text for summary information.

E. ALTERNATIVES CONSIDERED

The FESA requires that HCPs identify alternatives to the proposed taking and explain why such alternatives were not selected. A broad range of impact avoidance, mitigation, and conservation strategies were proposed and considered in the course of preparing this Plan, including variations on the LTSY projections and HCP strategies.

Four primary alternatives are summarized here: No Take; Selective Harvest; Expanded (61,000-acre) Headwaters Reserve; and Higher Midterm Timber Production.

1. TAKE AVOIDANCE

Under this alternative, activities in the Plan Area would be conducted in a manner to avoid take of any federally listed, state listed, or state candidate species. Since no take would occur, PALCO would not need or obtain ITPs from USFWS, NMFS, or CDFG. PALCO would not be obligated to implement measures to minimize and mitigate the effects of take. Consequently, the Headwaters Reserve would not be established and the Plan would not be implemented. This alternative was rejected because it would not provide the following environmental benefits associated with the Plan as proposed:

1. Protection of the Headwaters Reserve, including buffer areas around the old growth forest within the Reserve, in perpetuity;
2. Protection of the MMCAs and associated internal buffer areas;
3. Implementation of a comprehensive, inter-related habitat conservation strategies for terrestrial and aquatic species in the Plan Area; and
4. Implementation of various conservation measures for non-listed Covered Species.

This alternative also was rejected because of its potential negative effects, including:

1. Fragmentation of second growth and residual stands adjacent to old growth areas with potential for resulting indirect impacts to old growth habitat areas through potential increased predation on marbled murrelets; and

2. Continued economic uncertainty regarding the amount of harvest that might be expected from the PALCO property in the future and the resulting adverse economic impact to the economy of Humboldt County.

2. SELECTIVE HARVEST

Under this alternative, the SYP elements of the Plan as proposed would be altered to eliminate clear-cutting and salvage logging in the Plan Area. Stands would be subject to selective harvest every 20 years, with a timber stand target of late seral forest conditions (CWHR 6). The maximum yearly harvest would be 2% of the timber inventory. In addition, a minimum of 20% of the property would have to be in late seral habitat. Two sub-alternatives for RMZs also were considered:

- FEMAT-standard buffers maintained for the term of the ITPs, and
- FEMAT-standard buffers as interim measures with final buffers being determined using a Washington Department of Natural Resources (DNR) style watershed analysis.

This alternative was not selected because a selective harvest strategy would require extensive road construction. It would limit PALCO's ability to use best silvicultural practices to manage its forests. The net improvement in aquatic protection over that in the proposed Plan is uncertain but is probably limited. The alternative would also have a significant negative economic impact on PALCO. With respect to economic impacts, the FEMAT buffers alone would render unharvestable over 50% of PALCO's ownership. (Map 36 in Volume V illustrates the application of FEMAT buffers to the Plan Area.)

3. EXPANDED HEADWATERS RESERVE

Under this alternative, a 61,000-acre reserve would be established instead the 7,500-acre reserve contemplated in the Headwaters Agreement. The approximate design of the reserve would be a large circle encompassing the six redwood groves (Allen Creek, Shaw Creek, Bell-Lawrence, Right 9, Owl Creek, Elkhead Springs) and the Headwaters tract and buffer. Outside of the reserve, the remainder of PALCO’s property would be managed in the same manner as proposed in this Plan.

Approximately 30 percent of PALCO's holdings in the Plan Area would become part of the reserve, include stands with significant amounts of high quality old growth timber. PALCO is unwilling to commit such a large amount of land to habitat without compensation, and neither the federal FESA nor CESA requires such a commitment. The only method of creating the preserve, then, is through condemnation or voluntary sale. Neither the federal nor state governments has demonstrated that funds are available to acquire the reserve; and California voters have turned down ballot measures aimed at acquiring this property. The acquisition amount would far exceed any conservation acquisition undertaken by the federal and state governments since the enactment

of the Land and Water Conservation Fund. In the absence of available funds for acquisition of the land, this alternative is not practicable.

4. INCREASED MIDTERM PRODUCTION

This alternative was developed to determine the possible upper range of timber production on PALCO's lands. Under this alternative, higher harvest levels would be allowed during the midterm of the ITPs. Riparian buffers would be 125 feet for Class I streams and 75 feet for Class II streams, with extensive timber harvest allowed within these zones. Limits on harvesting would be set by existing FPRs. No MMCAs would be established, however, the Headwaters transactions would be completed. This alternative was rejected primarily because of the inherent conflicts between the timber production goals of the approach and ITP requirements to minimize as well as mitigate effects on listed species.

F. OPERATING CONSERVATION PROGRAMS

1. MARBLED MURRELET CONSERVATION PLAN

a. Management Objective

Protect most of the best quality marbled murrelet occupied habitat on the property in a system of reserves, and provide for improvement of habitat within the reserves during the life of the permit. Minimize the effects of management on populations within reserves, and on murrelets that may be using habitat authorized for harvest.

b. Conservation Measures

1) Establishment of Marbled Murrelet Conservation Areas and Other Protective Buffers

- Establish MMCAs as described below. All MMCAs, with the exception of the provisional Grizzly Creek MMCA described in section 1c below, will be protected for the life of the permit.
- The Owl Creek MMCA identified in the July draft HCP will be included among the MMCAs protected for the life of the permit, and will include additions. These expansions are depicted in Figures 4A, 4B, and 4C.
- The Grizzly Creek complex, as identified in Figure 3 will be protected for the first five years of the permit. As described in the IA, at the end of five years, any portions of this area remaining in the ownership of PALCO will be evaluated by a panel and USFWS and CDFG. The agencies will then make a finding as to whether allowing timber harvest and the other Covered Activities in the complex would jeopardize the marbled murrelet. If the agencies determine that harvest of the area would jeopardize the murrelet, the area would be protected as an MMCA for the life of permit. If the agencies determine that harvest of the area would not jeopardize the species, the area

would not be designated as an MMCA and would be managed in accordance with the HCP's Operating Conservation Plan for Covered Lands outside of MMCAs. The area includes that identified in the July draft HCP, and several additions. These enlargements are included in Figures 4A, 4B, and 4C.

- A process will be established for further delineation of boundaries of MMCAs and conditions within MMCAs within first year of permit. Aerial photos, maps, written descriptions, and where feasible, GPS points, will be used to describe boundaries. Videos will document existing conditions along all roads within MMCAs. When THPs are proposed in stands contiguous with MMCAs, formal land surveys will be conducted to establish boundaries prior to harvest.
- Buffers around old-growth habitat are applied to reduce the potential for access by avian predators and ameliorating climatic effects. To provide these benefits, the timber stand within the buffer should be provide a high degree of canopy closure at a height as close to the height of the old-growth habitat as possible. In some cases, where intervening features such as ridgelines and roads would substantially reduce the effectiveness of buffers, vegetated buffers may not be deemed necessary. Where the benefits of buffers could be attained using property owned by PL, the MMCAs were designed with 300 foot buffers incorporated within their boundaries. However in several instances, additional buffers are or may be appropriate. These additional instances are described below.
- Additional 300-foot buffers will be established at certain points along the south edge of the Headwaters Reserve and the northwest edge of the N. Fk. Elk MMCA.
- If property bordering an MMCA is acquired by PALCO, buffers shall be added to the MMCA immediately on the acquired property, and the acquired property will be subject to the measures described in OCP relating to areas adjacent to MMCAs.
- During the review of boundaries described in the fourth bullet above, the mapped buffers will be reviewed to ensure that they meet the objectives of protection of MMCA values to the maximum extent feasible, and to consider whether additional buffers should be added to meet the objectives. In addition to the need for species protection, this process will fully consider limitations of effectiveness due to intervening features and practicality of delineation (for instance, use of existing features such as roads and ridges versus establishing boundaries by land surveys).

2) Activities in MMCAs

Management in the MMCAs. Management in the MMCAs shall be consistent with the goals and objectives of the MMCAs, and, except as expressly provided here, shall be conducted in consultation with the USFWS and CDFG. The goals and objectives of the MMCAs are as follows:

- Maintain the value of currently suitable marbled murrelet nesting habitat in the MMCAs.
- Recruit suitable marbled murrelet nesting habitat in old growth residual stands in the MMCAs.

- Provide buffering for, and contiguity of suitable and recruitment nesting habitat in young growth stands within the MMCAs.

MMCA Silviculture. In consultation and with the concurrence, or at the request of USFWS and CDFG, at PALCO's option, the silvicultural prescriptions described below may be employed to advance the goals and objectives of the MMCAs. PALCO is not required to undertake any such management in the MMCAs.

- Old growth stand components within MMCAs are to be dedicated to retention and enhancement of murrelet nesting habitat values. No harvest or salvage activities, exemption harvest, emergency timber operations, or except as provided below, other timber operations, shall be conducted.
- Residual stand components are to be managed to recruit functional murrelet nesting habitat. Thinning of second growth within residual may be permitted with consultation and concurrence by USFWS and CDFG to enhance recruitment of second-growth trees into the residual overstory. Any permitted thinning shall occur outside of murrelet nesting season and without the construction or reconstruction of roads. No helicopter yarding shall be conducted. Permitted thinning shall require compliance with NEPA, CEQA, ESA, CESA, and any other applicable laws.
- Second growth stand components within and outside of residuals are to be managed to buffer old growth and residual habitat and provide mature forest contiguity throughout MMCAs. Thinning may be allowed with the concurrence of USFWS and CDFG and shall require compliance with NEPA, CEQA, ESA, CESA, and any other applicable laws. The objective of such thinning would be to accelerate recruitment of second growth trees into a mature condition which buffers residual and old growth canopy structure. Any permitted thinning shall occur outside of murrelet nesting season and without the construction or reconstruction of roads. No helicopter yarding shall be conducted.

MMCA Infrastructure and Land Use. Certain activities, roads and other facilities within the MMCAs on PALCO's lands will remain available for use, consistent with Aquatic Conservation Plan and the Implementation Agreement regarding this Plan and subject to the below conditions. These activities are deemed to be compatible with protection of the marbled murrelet and its habitat within the MMCAs:

- Existing, active, previously used haul roads, within MMCAs may be used, maintained, stormproofed, upgraded, closed or decommissioned as limited by Section 3.1.1(a)(1) of the IA. Active roads within the MMCAs are mapped at Section 8 and Section 12 attached hereto.
- Properly licensed and permitted game hunting -- including firearm discharge -- may continue, during the appropriate seasons, from and after September 16 of each year until March 23, to avoid potential disturbance to nesting murrelets.
- Maintenance and use of existing roads and facilities can require the removal of trees. To the extent feasible, such activities with potential for disturbance shall be conducted outside the marbled murrelet breeding season. All trees removed within the RMZ or

blocking a road will be left in the vicinity of its removal. See IA at 3.1.1(a)(1) and (5).

- Fuel removal will be allowed only in residual and second growth buffers and will require consultation and written concurrence from USFWS and CDFG.
- Fire suppression will be allowed as otherwise provided in a fire management plan for the MMCAs approved by the Wildlife Agencies within one year of the effective date of this Plan.
- Tree removal or salvage necessary for road maintenance, stormproofing, upgrading closure or decommissioning shall be kept to a minimum. Downed, wind thrown and hazard trees within the RMZ must be retained as required by the terms of the Aquatics Species Conservation Plan.
- Stream enhancement projects in the MMCAs may be undertaken with prior written concurrence of USFWS and CDFG.
- Borrow pits and rock material sources within the MMCAs may be opened, and the material used for roads, drainage, maintenance, and repair without consultation or concurrence with USFWS and CDFG so long as no trees greater than 12" dbh are removed from said locations, and no single new borrow pit area greater than 2 acres is cleared, with a maximum limit of no more than 2 new sites in any MMCA, with a cumulative total area of 4 acres cleared, after the effective date of this permit, for the full life of the permit, in any one MMCA. Any borrow pit site tree removal or land clearance in excess of these limits from and after the effective date of this permit will require consultation with and concurrence by USFWS and CDFG and full compliance with applicable federal and state laws including NEPA, CEQA, USFWSA, and CEQA. Borrow pits are covered activities under the ITPs for a period of 5 years from the date the ITPs are issued. Use of borrow pits after the five-year period is prohibited in the MMCA until the ITPs have been amended to extend coverage.
- Scientific surveys and studies as part of the Plan monitoring program described infra may be undertaken.
- Within the Allen Creek MMCA, as configured in consultation with USFWS and CDFG, is located one of PALCO's permitted hard rock quarries: Quarry 1, Road 24. The specific location, environmental setting, permit provisions, mitigations, certified environmental documentation and approved reclamation plan for this permitted and active quarry are included in the July 1998 Draft HCP. Briefly, Quarry 1/Road 24 is located in the Yager Creek drainage, approximately 5 miles upstream from Carlotta, California. While quarrying operations typically involve excavation, drilling, blasting, screening, loading and related activities throughout the year, in recognition of the potential for disturbance effects upon murrelets in the Allen Creek MMCA, PALCO will limit all blasting to the period after September 15 and prior to March 24 of each year. To the maximum extent feasible, PALCO will also implement measures to mitigate disturbance impacts at other times of the year. These measures will include the recommendations by CDFG, for this quarry operation during the environmental review and permitting process. These measures are:

- The loading of smaller aggregate into empty trucks prior to large rock, to lessen the impact of large rock; and
- The noise generated by the back gate striking the body of the dump truck should be mitigated by one of several methods: (1) pulling away from the dump site slowly; (2) padding the area between the gate and the body; or (3) removing the back gate from the body of the truck.
- The Allen Creek MMCA rock quarry is permitted as a Covered Activity for 2 years from the date of permit issuance. Use of the quarry beyond the two year period will require an amendment to the ITPs.

3) Minimization of Take of Marbled Murrelets

- Establish 0.25 mile seasonal buffers and 300-foot buffers with PALCO's late seral silvicultural prescription (240 sq. ft per acre conifer basal area following harvest) on PALCO lands bordering old-growth marbled murrelet habitat on public lands.
- Review all activities proposed within MMCAs, and within 0.25 miles of MMCAs, within 0.25 miles of old-growth habitat in parks and acquired reserves, and within 0.25 miles of other occupied stands, to ensure that disturbance of murrelets in MMCAs has been minimized to the greatest extent feasible. This process will include recognition of and coordination with other HCP resource management objectives, especially aquatic protections. A checklist will be established for documentation and will be included with THPs and also completed for other management actions. Checklist elements will include, but not be limited to, the following:

  - Consultation with agencies completed on any harvest, thinning, or salvage activities
  - Consultation with agencies completed on road maintenance or stormproofing
  - Fuel treatments consistent with MMCA fire management plan
  - Down or felled trees in MMCA retained per aquatic strategy
  - Consultation with agencies completed on stream restoration projects
  - Consultation with agencies completed on opening or operation of quarries and rock borrow pits
  - Seasonal restriction applied within 0.25 of parks and reserves
  - Late seral prescription applied within 300 feet of parks and reserves
- A rating process will be established for residual and old growth stands that have not been surveyed according to the protocol existing at the time, using factors such as proximity to occupied stands, canopy closure, stems per acre, volume per acre, and stand size. (Field measurements such as platform availability and surveys are not required in this process.) The rating will divide unsurveyed residual and uncut old-growth into two equal groups by acreage. The group with poorer habitat rating may be harvested without other restrictions related to murrelets, except for inclusion in the prioritization process described in the last bullet below. The group with the better

habitat rating will be subject to the take minimization process described in the next bullet below and the prioritization process described in the last bullet.

- To minimize take of nesting murrelets, eggs, and young, in the stands rated as better habitat in measure 3c, and in the occupied stands authorized for harvest, operations associated with falling (road construction, marking, layout construction, and falling) will occur outside the breeding season. Operations associated with log removal (e.g., yarding, loading, and hauling) may take place at any time, except: 1) within 0.25 mile of MMCAs or other occupied habitat (and thus subject to review under process described in the second bullet above) or 2) as restricted by other HCP measures, or 3) where restricted by other laws or regulations.
- For old-growth and residual redwood authorized for harvest, including the better habitat group identified in the process described in the third bullet above, conduct prioritization process for harvest. Overlay other constraints (e.g., inner gorge, mass wasting, etc.) to identify acreage tentatively available for harvest in the short-term. To this available acreage, apply prioritization of murrelet habitat, using factors such as existing survey results, proximity to MMCAs and other occupied habitat, canopy closure, stems per acre, volume per acre, and stand size. The USFWS, CDFG and PALCO will work cooperatively to schedule harvest of old-growth redwood and residual old-growth redwood outside the MMCAs in a manner which minimizes impacts to marbled murrelets.

c. Monitoring

The Company will monitor this HCP on its lands, on lands transferred to PALCO under the proposed land exchange, and on other adjacent lands and waters. The goals will be as follows:

1. To determine whether the HCP conservation strategies are implemented as written;
2. To determine whether the conservation strategies are having the predicted impact and effect on marbled murrelets.

These two monitoring goals can be regarded as implementation (or compliance) monitoring, and effectiveness monitoring, respectively. These goals follow from the recommendations of the USFWS (Recovery Plan), and mirror similar efforts elsewhere in the region (e.g. Madsen et al 1997, for federal lands).

Implementation/compliance monitoring will be carried out by the HCP Monitor, as described in section F-13, who has full access to PALCO's land, at all times, to inspect any Covered Activity, and shall be present on site during every timber harvest conducted by or on behalf of PALCO. Implementation monitoring will also, document the types, amounts, and locations of forest management activities carried out within the HCP planning area. These monitoring activities may take the form of periodic reports on landscape-level conditions, using inventory and remote sensing information. .For purposes of this routine compliance monitoring, in which landscape changes over time are recorded, the Northwest Forest Plan (FEMAT) provides for reports every 10 years. This Plan provides for a report every 5 years to USFWS and CDFG, documenting (through aerial photography GIS mapping, GPS reference points where available, and other methods available and

appropriate) status, changes and trends in the MMCA areas. Items to be addressed in the report will include, but not be limited to, the following:

- Depiction of the MMCA boundaries and indications of the location and scope of nearby harvest operations.
- General description of any silvicultural activities undertaken in accordance with section 3.1.1 of the IA with the advice and consent of USFWS and CDFG within the MMCAs, and a record of the consultation, correspondence, planning or other documentation associated with such activity.
- Depiction, description or other documentation, to the extent available, of any other consultation or correspondence between PALCO and USFWS/CDFG regarding any of the following:
  - Use, abandonment or reclamation of the permitted Rock Quarry No. 2/Road 24 located within the Allen Creek MMCA;
  - Use, or tree removal to facilitate borrow pit material sources within the MMCAs, as provided in this Plan;
  - Road use, maintenance, stormproofing, drainage repair or maintenance, or related tree removal for same as provided in this Plan.
  - Tree removal due to safety hazards.

Effectiveness monitoring will seek to document changes in the marbled murrelet populations on Company lands, and, to a lesser degree, on neighboring lands and waters, and changes in the habitat of these populations on Company lands, as more particularly described below.

Effectiveness monitoring will be carried out by PALCO personnel, and/or by outside contractors including the HCP Monitor, approved by the Wildlife Agencies. The program will be overseen by the Company's existing Scientific Review Panel, who will meet annually for the first five years of the plan to review monitoring program design, results, and to make recommendations for future studies. All data and results will also be reported to USFWS and CDFG. Summaries of data and analyses will be presented quarterly. An annual report of all data and analyses will be presented annually, in February/March.

Prior to the design and implementation of any monitoring plan, the Company will seek advice from statistical consultants on the most appropriate design of monitoring. This advice will include explicit treatment of statistical power, and the necessary effort to determine whether effects have occurred. These preliminary studies will then be used to guide the monitoring program, in consultation with the Scientific Review Panel, USFWS and CDFG.

1) Conservation Objectives Guiding Monitoring Efforts

Specific objectives of the conservation program that will guide the effectiveness monitoring process include:

- Maintain marbled murrelet nesting activity in the occupied stands within the MMCAs;
- Recruit closed canopy high basal area second growth buffers for residual and old growth stands in the MMCAs;

- Recruit second growth that provides shelter for nest platforms in residual stands in the MMCAs;
- Minimize new development or activity which could disturb murrelet nesting in MMCAs.

2) Research and Management Questions to be Addressed By Monitoring Efforts

Monitoring associated with the conservation objectives in this plan is intended to respond to the following research and management questions:

- Are marbled murrelets continuing to use MMCA stands?
- What are the trends in local marbled murrelet populations?
- What is the condition and distribution of habitat in the MMCAs and reserves?

3) Use of MMCA Stands

Marbled murrelet surveys have previously been carried out in the MMCAs , in the Headwaters Reserve area, and in the Humboldt Redwoods State Park. The Company will continue to monitor murrelets in the MMCAs, in order to determine the continued occupancy of these stands, and to gauge the levels of use of the stands. This will allow an assessment of the impact, if any, of management and conservation measures described in this Plan on the patterns of occupancy. At the same time, the Company will cooperate with federal and state land management agencies to monitor in the Headwaters Reserve, and in the State Park; areas within these stands will essentially serve as controls for any changes that occur in the MMCAs.

Surveys will be carried out by staff or contractors, according to the basic methods set out in the 1998 Pacific Seabird Group protocol, and will determine the number and type of murrelet detections. The overall goal of the monitoring program is to determine whether the MMCAs continue to be 'occupied.' Essentially, the issue is whether the harvest of residual old growth and second-growth outside of the MMCAs is having any detrimental effect on habitat quality within the MMCAs, and if so, to determine the relative impact to the species from that effect.

Five MMCA areas will be monitored, with two survey areas in Allen Creek, and one each in Bell Lawrence, Shaw Gift, Cooper Mill and Grizzly Creek. In addition, subject to permission and access, several control sites will be set up in the Headwaters Reserve (3 areas), and in Humboldt Redwoods State Park (2 areas). This constitutes a minimum of 11 survey areas, each surveyed multiple times annually. The surveys will be set up in such a way as to ensure that there is adequate statistical power to compare MMCA and reserve stands. The surveys may depart from PSG protocol, and should be designed so that maximum power is obtained per effort. Hence surveys may be concentrated in those parts of the season which allow the best assessment of status, and located in optimal viewing areas.

A subsidiary goal of the survey program will be to refine existing knowledge of the relative density of murrelets in different forest stands. It is anticipated that such refinement may allow the use of improved metrics of marbled murrelet habitat use. Additional research or survey methods (radar, telemetry, etc.) may be used if these are appropriate. At this point, inland surveys are not , by

themselves, thought to monitor adequately marbled murrelet numbers effectively enough to allow estimates of population trends (Madsen et al. 1997).

4) Marbled Murrelet Population Trends

Estimates of marbled murrelet population sizes and trends are most effectively monitored at sea. The Northwest Forest Plan (FEMAT) effectiveness monitoring team has recently discussed the best available methods for at-sea monitoring (Madsen et al 1997). The overall goal of that plan is to develop effectiveness monitoring for the Pacific Northwest. If murrelet populations are shown to continue to decline in the region, it is anticipated that the FEMAT implementation will be reevaluated. The Company has long been a contributor to a cooperative effort by government and industry to facilitate at-sea survey efforts in this area. That contribution to the now decade long monitoring program of the US Forest Service will continue under this HCP, and will supplement the proposed federal effort.

It is anticipated that off-shore monitoring will be carried out by USDA Forest Service, and/or outside contractors. The Company will contribute $30,000 annually for at least the first five years to the existing cooperative research and monitoring effort through the Marbled Murrelet Study Trust, or US Forest Service, PSW Station. The Scientific Review Panel has indicated that this timeframe is necessary to detect any change in population trends (Section 7). The same timeframe is also indicated by power analyses of population surveys elsewhere in California (Becker et al 1997).

If, in the short term, population decline stabilizes, reverses, or continues at the present or lowered rates in the offshore population, this will indicate that the HCP has not adversely affected the population. If however the rate of decline increases, and such a decline is not matched elsewhere in northern California, the Scientific Review Panel will be consulted.

If offshore monitoring shows a substantial decrease in productivity from existing levels, this may suggest that the population is declining more rapidly than predicted under this HCP. The Scientific Review Panel will help to determine the interpretation of the available information. However, no land management adjustments are required or anticipated under this Plan pursuant to results or analyses of offshore census data.

The timing and placement of offshore surveys will inevitably be subject to varied effort, due to weather, sea state etc. To the extent practicable, PALCO will support surveys as guided by power analysis and the advise of the Science Advisory Panel. PALCO will, to the extent practicable, ensure a minimum of three surveys annually on the waters offshore from the PALCO ownership.

5) Condition and Distribution of Habitat in MMCAs and Reserves

Multiple plots will be set up within MMCAs and MMCA buffers. These will be sampled every five years for the following attributes:

Platform density and type

Residuals/acre

Status of understory

height

DBH

Species

The size, number and distribution of vegetation plots will be determined after an initial sampling period. These data will be used to perform power analysis to determine the design of subsequent sampling efforts.

6) Effectiveness Monitoring Annual Report and Consultation

Annually, PALCO will provide to USFWS and CDFG a report (Effectiveness Monitoring Report or Reports) detailing the following:

- The monitoring survey locations, results, data and analyses undertaken during the past year pursuant to this Plan;
- Depictions, descriptions or discussions of any purpose, planning or design documentation related to effectiveness monitoring anticipated for the coming year.

No sooner than 30 days after the provision of the Annual Effectiveness Monitoring Report, PALCO shall conduct a consultation meeting with USFWS and CDFG to discuss the Report and means, methods, techniques or adjustments in survey effort, data analyses or results interpretations. This consultation shall be advisory only with the goal of refining survey or analytical efforts to achieve the objectives and answer the research and management questions described above.

Following the consultation meeting with USFWS and CDFG, for at least the first 5 years of the effective term of this Plan, PALCO shall convene a meeting of the Scientific Advisory Panel to obtain the Panel's input and advice regarding effectiveness monitoring techniques, data management, analysis and interpretation, protocols or other related material and information. PALCO shall provide USFWS and CDFG at least 30 days advance notice of the date, time and place it will be convening the Panel, provide USFWS and CDFG access and opportunity to participate, and will prepare a summary and minutes of the proceedings.

Implementation and Compliance

- A “Pacific Lumber Company Timber Harvest Plan Checklist” will be used to confirm that all relevant elements of the Operating Conservation Plan will be implemented and made enforceable under timber harvest plans. These checklist shall be attached to each timber harvest plan and reviewed during implementation monitoring In addition, the HCP Monitor (refer to Section F-13) will be onsite on every harvest plan.
- Establish research fund (separate from process in 4 above) to provide funding for research into the conservation needs of marbled murrelet. Funding will be applied according to recommendations of scientific panel and agencies, with addition of one member of Marbled Murrelet Recovery Team. Funding may be applied to projects

within MMCZ 4 and 5. Provide funds at $200,000 per year for first 5 years; $100,000 per year for next 5 years.

2. NORTHERN SPOTTED OWL CONSERVATION PLAN

This conservation strategy is a "habitat based" approach. It includes the harvest, retention and recruitment of requisite habitat types and elements within watershed assessment areas and individual activity sites. This approach will be complemented by procedures applied during covered activities to (1) minimize disturbance to Northern Spotted Owl (NSO) activity sites, (2) monitor to determine whether these efforts maintain a high density and productive population of NSOs on the ownership, and (3) apply adaptive management techniques when PALCO, the USFWS, CDFG and scientific community learn more about biology of the NSO or if management objectives are not met. The NSO strategy will rely upon other conservation elements of the HCP for the retention and recruitment of potential foraging, roosting and nesting habitat in watersheds across the ownership and through the HCP period. Specifically, the silvicultural requirements associated with riparian management zones, the mass wasting avoidance strategy, cumulative effects/disturbance index restrictions, marbled murrelet conservation areas, and retention standard of 10% late seral habitat for each Watershed Assessment Area (WAA) are likely to provide habitat which NSOs may find suitable. At individual activity sites, the strategy provides specific habitat retention requirements to conserve habitat for foraging, roosting and nesting.

The following definitions are used herein:
Activity Site – An activity site (or activity center) is the area including the primary roost tree of a non-nesting pair or single NSO, or the nest tree of a nesting pair. The most current location shall be used. If the location is not defined by a nest tree, the primary roost tree shall be selected, based upon the area where the NSOs are most consistently located. Indicators such as regurgitated pellets, whitewash, etc. shall be used in determining the primary roost tree. The activity site must be confirmed using status as determined by a daytime follow-up visit.

Pair – Status will be determined if on two visits spaced at least one week apart before May 1, or one visit after May 1, a male and female are seen/heard within 0.25 miles of each other or: (a) a male is observed taking a mouse to a female; (b) a female is observed on a nest; or (c) young are detected with an adult.

Nesting Pair – Status will be determined if on two visits spaced at least one week apart before May 1, or one visit after May 1, a male and female are seen/heard within 0.25 miles of each other on the same visit and any of the following: (a) a female is observed on a nest; (b) either a male or female is observed delivering prey to a nest; (c) a female is observed with a brood patch (mid-April to mid-June), or (d) young are detected with an adult.

Reproductive rate (i.e., nesting success) – Calculated annually by dividing the total number of fledglings observed by the total number of NSO pairs monitored to determine reproductive output.

Suitable Northern Spotted Owl Habitat - For purposes of characterizing foraging, roosting and nesting. Table 7 should be used (also refer to Adaptive Management measure 2).

a. Management Objectives

1. Retain a minimum of 108 activity sites each year over the life of the HCP. Refer to Table 6.

2. Maintain NSO pairs on an average of 80% of the activity sites on the ownership.

3. Maintain an average reproductive rate of at least 0.61 fledged young per pair.

4. During the initial five years of the HCP, maintain and document the following minimum number of activity sites:

b. Conservation Measures

1. The PALCO, USFWS, and CDFG shall establish a Scientific Advisory Panel, in the same manner identified for the Grizzly Creek Panel in 3.1.2 of the IA. This panel shall review and make recommendations for monitoring techniques, offer expert review of monitoring results**,** and make recommendations to PALCO on habitat retention standards for maintenance and recruitment of NSO activity sites. This same panel shall provide expert review and recommendations for implementation of the marbled murrelet conservation measures. This panel shall be convened, at a minimum, in years 1, 6 and 11 following issuance of the ITP.

2. Conduct complete annual censuses to monitor all activity sites on the ownership and determine numbers of pairs, nesting pairs and reproductive rates. PALCO may use a sampling methodology, rather than a complete census, provided the sampling proposal has been reviewed by the Scientific Advisory Panel and approved by USFWS and CDFG. Monitoring data shall be provided annually to the Scientific Advisory Panel, the USFWS, and CDFG.

3. Surveys

   - For active operations which are initiated prior to the onset of the breeding season (March 1), the THP area and a 1000' buffer will be surveyed, with one visit between March 1 and March 15, or later if necessary. Two additional surveys, at least one week apart will be performed between March 15 and August 31.
   - For new operations initiated between March 1 and August 31, the THP area and a 1000' buffer shall be surveyed. Three survey visits, each separated by at least one week, shall occur prior to the start of operations but after March 1.
   - When NSOs are contacted on the surveys, a daytime follow-up will be conducted as soon as possible to determine nesting status (also see Definition of Nesting Pair). If NSOs are detected within areas where management activities will occur, operations shall cease until status is determined.
   - Once nesting status has been determined, the following three Conservation Measures (4, 5, 6) shall be implemented.

4. PALCO shall select and identify to USFWS and CDFG before June 1 each year at least 80 activity sites which shall be maintained using the following habitat retention guidelines (referred to as Level One Protection). Activity sites selected for Level One habitat retention must have supported NSOs in the previous year and must also be active for the year in which the site is selected. PALCO may select any 80 activity sites which meet Level One habitat retention standards. Selection of a site in one year does not imply that the site must be maintained in subsequent years.

    - For activity sites where the NSO status has been determined to be nesting; or until a wildlife biologist determines that nesting has failed, or that young are capable of avoiding direct impacts of timber harvest (e.g., young are capable of sustained flight or can take live prey independently), no harvesting shall occur during the breeding season (March 1 through August 31) within a 1000' radius of the nest tree.
    - Within 500 feet of the activity center the characteristics of suitable nesting habitat, if present, must be maintained. No timber operations, including salvage, shall be conducted in this area during the breeding season unless approved by the USFWS and CDFG. Timber operations may be conducted in this area outside the breeding season if appropriate measures are adopted to protect suitable nesting habitat.
    - Within 500-1000 feet of the activity center, retain sufficient suitable characteristics, if present, to support roosting and provide protection from predation and storms.
    - 500 acres of suitable NSO habitat must be provided, if present, within 0.7 mile of the activity center. Less than 50% of the retained habitat shall be under operation in any one year. If less than 500 acres of suitable NSO habitat are present, the acreage shall not be reduced. The 500 acres should be as contiguous as possible.
    - 1336 total acres of suitable NSO habitat must be provided, if present, within 1.3 miles of each activity site. If less than 1336 acres of suitable NSO habitat are present, the acreage shall not be reduced.
    - The shape of the areas established for habitat retention objectives shall be adjusted to conform to natural landscape attributes such as draws and stream courses while retaining the total area required.

5. At activity sites which have not been designated for Level One protection, PALCO shall apply Level Two protection measures as follows:

    - For activity sites where the NSO status has been determined to be nesting; or until a wildlife biologist determines that nesting has failed, or that young are capable of avoiding direct impacts of timber harvest (e.g., young are capable of sustained flight or can take prey independently), no harvesting shall occur during the breeding season (March 1 through August 31) within a 1000' radius of the nest tree.

- Following the breeding season, 18 acres around the activity site shall be maintained as suitable nesting habitat, if present. The protected 18 acres shall conform to natural landscape features, as designated by PALCO's wildlife biologist, and the buffer protecting the activity site must be at least 400' wide.
- For activity sites which have been determined to be occupied by a non-nesting pair or single NSO, 18 acres around the activity site shall be maintained as suitable nesting habitat, if present. The protected 18 acres shall conform to natural landscape features, as designated by PALCO's wildlife biologist, and the buffer protecting the activity site must be at least 400' wide. Harvesting may occur during the breeding season, at PALCO's discretion adjoining the 18 acre habitat retention area.

6. Activity sites which are not needed to meet Management Objectives a1 or a4 may be harvested before March 1 or after August 31. All nest trees shall be marked by PALCO's wildlife biologist and shall be retained if the activity site is harvested.

c. Adaptive Management

1. PALCO is encouraged to conduct research to identify alternative activity site retention models for long-term management through the permit period. After five years, or at any later date during the permit period, PALCO may present for review by the Scientific Advisory Panel, alternative activity site retention models, to substitute for Conservation Measures under b4 (bullets 4 and 5). Alternative activity site retention models shall not be implemented until they have been reviewed and approved by the USFWS and DFG. PALCO may use these models to manage for recruitment of suitable habitat and potential establishment of new activity sites.

2. PALCO, USFWS or CDFG may at any time propose modifications to the characterizations of NSO suitable habitat provided in Definition 5 (Table 2). Proposals shall be validated against any relevant data including that collected in the performance of Conservation Measure b2. The Scientific Advisory Panel shall review applicable information and provide a recommendation to PALCO, USFWS and CDFG who shall mutually agree upon any modifications.

3. Management objectives may be modified if new information becomes available following review of the Scientific Advisory Panel and approval by USFWS and CDFG.

4. The seasonal bounds and duration of the prohibition on harvesting adjacent to activity sites may be modified based upon ownership specific information provided at PALCO's discretion upon review by the Scientific Advisory Panel and approval by USFWS and DFG.

5. The actual or estimated number of activity sites shall remain at or above Management Objectives a1 and a4 for each year of the HCP. If the applicable management objective is not achieved for any year of Plan operations, or if, for any reason PALCO

is unable to accomplish Conservation Measure b4, PALCO shall convene the Scientific Advisory Panel for a joint meeting with USFWS and CDFG to review potential reasons why the objectives are not being met and potential corrective measures to implement. PALCO, USFWS and CDFG shall jointly develop modified or additional measures to conserve activity sites, including the potential implementation of no-take management procedures. Any modifications shall be consistent with the issuance criteria for (10(a)(1)(B) of the FESA, and the State Endangered Species Act.

6. Proportions of activity sites occupied by pairs and reproductive rates shall be averaged over running five-year periods. If the five-year average for either parameter does not meet the management objective, PALCO shall convene the Scientific Advisory Panel for a joint meeting with USFWS and CDFG to review potential reasons why the objectives are not being met and potential corrective measures to implement. Following this consultation PALCO, USFWS and CDFG shall jointly develop modifications for Conservation Measures in Part b. Any modifications shall be consistent with issuance criteria for (10(a)(1)(B) of the FESA, and the State Endangered Species Act.

7. Management Objective a1 and Conservation Measure b4 may be modified commensurate with changes in size of the ownership following review by the Scientific Advisory Panel and approval by the USFWS and CDFG. Modifications, based upon size of the ownership and scope of incidental take coverage extended by USFWS and CDFG may be proposed either by PALCO or the wildlife agencies.

3. AQUATIC SPECIES CONSERVATION PLAN

a. Management Objective

The goal of the aquatic conservation plan is to maintain or achieve, over time, a properly functioning aquatic habitat condition. This condition, as defined by NMFS, is essential for the long term survival of anadromous salmonids and is identified in a matrix with habitat variables necessary to achieve this goal. Not all variables will be attainable over the life of the Plan, regardless of PALCO's effort, specifically the recruitment of large wood onto the forest floor and into the watercourses. For this reason and because habitat conditions are not static, the specific habitat variables are not enforceable standards under the Plan. The attainment of the conservation goal is the corner stone of the entire aquatic conservation plan.

The key variables are water temperature, canopy cover, sediment, instream large wood, large wood recruitment, pool frequency, and pool quality. Refer to the July 1998 Draft HCP, Volume IV, Part D, Section 6 for the quantitative and qualitative targets for each variable and Table 8 for a summary.

b. Watershed Analysis

1) Process

1. Watershed analysis is required for all covered lands in the HCP.

2. Within 60 days from the Effective Date, PALCO in consultation with the Wildlife Agencies, shall establish a schedule that results in completion of the initial watershed analysis processes for all covered lands within 5 years of the issuance of the incidental take permit.

3. A modified version of Washington Forest Practices Board Manual: Standard Methodology for Conducting Watershed Analysis - Version 4.0, November 1997 (a.k.a. Washington Department of Natural Resources (WDNR) methodology) process or a modified version of the most current WDNR methodology shall be used. The process shall include an assessment, synthesis (with a cumulative effects assessment), prescription development, monitoring and revisitation.

4. Variations on the methodology and modules will be approved by NMFS and USFWS, in consultation with state agencies. PALCO may also recommend variations.

5. The assessment modules from the WDNR methodology that will be used, in a modified format, include: mass wasting, surface erosion, riparian function, fish habitat, and stream channel assessment. The Pacific Watershed Associates (PWA) sediment source assessment methodology (July 1998 Draft HCP, Volume II, Part O, with Attachments), with additions for non-road related surface erosion, may be used in place of the surface erosion module. Water quality "critical and key" questions may also be incorporated into the assessment.

6. "Key and critical" (as used in the WDNR methodology) questions for use in the modules, will be customized for HCP covered species and PALCO's ownership.

7. A distinct cumulative effects assessment is a required variation of the watershed analysis process. The new process used during watershed analysis shall include, but is not limited to, the information which has been developed as part of the Disturbance Index assessments done prior to completion of the watershed analysis.

8. An amphibian and reptile assessment module shall be developed which includes key and critical questions regarding life history requirements, including those upslope of the RMZ boundaries. This module will be used as part of every watershed analysis. Results from this module shall be integrated into synthesis and prescription development to minimize and mitigate management effects on all phases of life history.

9. The area analyzed shall be watershed(s) of approximately 10,000 to 50,000 acres, as delineated by the Wildlife Agencies and PALCO, and approved by the Wildlife Agencies. These analysis areas will be similar to the size of several planning watersheds or single hydrologic unit.

10. Entire watersheds/analysis areas where PALCO owns all or portions of the land will be assessed. A Level 2 assessment (as described by the WDNR methodology) is required for all

lands owned by PALCO in specified watersheds/analysis areas, at the time of the analysis. A Level 1 assessment is required for lands not owned by PALCO, at the time of the analysis.

11. The analysis will be performed by an interdisciplinary team of qualified scientists and technical staff.

12. At least one representative from PALCO and each of the Wildlife Agencies will serve on the analysis teams. If available, a representative from U.S. Environmental Protection Agency and California Department of Conservation will also serve on the analysis teams. The North Coast Regional Water Quality Control Board and CDF may also participate on the teams.

13. The Wildlife Agencies shall review each watershed analysis upon its completion.

14. Timelines for completion of the individual components according to the WDNR methodology are not required. However, timelines for completion of these various components of the analysis will be developed based on mutual agreement between PALCO and the Wildlife Agencies on an individual watershed analysis basis.

15. The watershed analysis process shall be open for public comment. PALCO will present to the public what the company will be doing with respect to each watershed analysis. The goal of this interaction is to obtain public input on problems and priorities. Members of the public that have been technically trained may also participate in the technical analysis. On completion of each watershed analysis, PALCO will also present the results of the watershed analysis and justifications of methodologies and prescriptions.

2) Post-Watershed Analysis Prescriptions

1. Site-specific prescriptions resulting from a watershed analysis must always be designed to achieve or maintain a properly functioning aquatic habitat condition (a.k.a. essential habitat elements), as defined by NMFS.

2. Watershed analysis may modify the following elements of the Aquatic Conservation Plan: hillslope management prescriptions; channel migration zone prescriptions; Class I, Class II and Class III RMZ prescriptions; the Disturbance Index; and, monitoring.

3. The Wildlife Agencies shall establish the site-specific prescriptions for implementation upon the completion of each watershed analysis.

4. PALCO shall implement the site-specific prescriptions established by the Wildlife Agencies.

5. If the Wildlife Agencies establish site-specific prescriptions that differ from prescriptions proposed in the watershed analysis, the agency shall state in writing its reasons for doing so.

5. The maximum and minimum limits for post-analysis prescriptions, as described below, set forth the range in which prescriptions may be modified for the Class I and II RMZ's.
6. The post-analysis minimum RMZ limits include:
    - RMZ prescriptions for both Class I and II waters shall be no less than 30 ft. no harvest zones (slope measurements) on each side of the waters.

- The Class II RMZ minimum 30 ft. no harvest zone (slope measurement) may be adjusted to a minimum 10 ft. no harvest zone if the NMFS or USFWS determine that this adjustment will benefit aquatic habitat or species.
- For Class I RMZs, if the initial watershed analysis or subsequent revisitations allows for harvest entry into the 30 ft. - 100 ft. zone, then the 18 largest conifer trees per acre shall be retained on each side of the waters per each harvest entry (i.e., the largest 18 trees preharvest shall be retained at the end of each harvest). The largest trees per acre in the minimum 30 ft. no harvest zone can be counted towards the total 18 trees per acre. If larger trees exist in the 100 ft. - 170 ft. zone than in the 0 ft. - 100 ft. zone, then trees in the 100 ft. - 170 ft. zone shall make up all or a portion of the 18 large trees per acre on each side of the waters for that specific entry.
- For the Class I and II RMZs, exclusive of the 18 largest trees per acre on each side of the waters, any additional tress left for retention shall include those that have the highest probability of recruitment to waters.
- California Forest Practice Rules in effect at the time of post watershed analysis prescription development apply to all other areas. At no time shall the prescriptions be less than required under the California Forest Practice Rules.

7. The post-analysis maximum RMZ limits include:
    - RMZ prescriptions for Class I and II waters shall be no greater than 170 ft. (horizontal measurement) on each side of the waters.
    - The RMZ minimum and maximum limits, as described above, will be taken into consideration during synthesis and prescription development.
    - Red tree vole, northern spotted owl and Pacific fisher habitat requirements and minimization and mitigation measures shall be taken into consideration during synthesis and prescription development. Proposed post-watershed prescriptions that have the potential to negatively impact habitat or minimization and mitigation measures for these species shall not reduce the overall capability of the hydrologic unit to provide for these species.
    - Prescriptions developed as a result of watershed analysis can not be extrapolated to other watersheds.

3) Peer Review, Monitoring & Revisitation

1. The NMFS and USFWS in consultation with CDF, the North Coast Regional Water Quality Control Board and the California Department of Fish and Game, shall establish a peer review process to evaluate, on a spot check basis, the appropriateness of completed analysis and prescriptions that are developed through the watershed analysis process prior to the completion of the first watershed analysis.

2. A peer review process may be requested if any PALCO or Wildlife Agency member of the watershed analysis team disagrees with one or more of the prescriptions recommended by the analysis team.

3. Monitoring objectives and hypotheses will be derived from the watershed analysis to assess effectiveness of prescriptions and trends in achieving a properly functioning aquatic habitat condition. Refer to the monitoring section.

4. Completed watershed analyses will be reviewed at 5 year intervals by PALCO and the Wildlife Agencies for the purpose of determining whether prescriptions are adequate. This review includes, but is not limited to, determinations as to whether new science has developed that might influence prescriptions, the watersheds response to prescriptions already implemented (monitoring), and whether watershed conditions have changed. The result may include revision of the prescriptions as part of adaptive management or conducting additional analysis which may also trigger prescription modification.

5. Any proposed prescription modification(s) resulting from a revisitation shall be subject to the same process as the initial analysis. This process includes NMFS and USFWS establishment of prescriptions to be implemented, maximum and minimum limits, peer review, etc.

6. Additional terms regarding watershed analysis are contained in the Implementation Agreement at section 3.1.3.1.

c. Control of Sediment from Roads and Other Sources

1) Sediment Assessment

1. PALCO will assess the existing road network and associated sediment sources on its lands either within 5 years as part of watershed analysis or within 5 years of the planned storm-proofing. Inventories will be updated within 5 years of the actual storm-proofing. The road assessments will be conducted according to Pacific Watershed Associates protocols (July 1998 Draft HCP, Volume II, Part O, with Attachments). The assessments must be completed in the following order:

   Elk River, Freshwater Creek, Lawrence Creek, Yager Creek (including Lower, N.F., Middle, S.F.), Van Duzen River, Middle Fork Eel River, Larabee/Sequoia Creek, Mattole River, Salmon Creek, Bear River.

2. Adjustments to the priority list above shall be made in consultation with the Wildlife Agencies.

3. All high and medium priority sites will be storm-proofed within five years of completion of the assessments, with all storm-proofing completed within 20 years of the Effective Date.

2) Road Storm-proofing

Roads will be storm-proofed to the standards identified in Weaver and Hagans (1994) within the first 20 years of the Plan, at a minimum rate of 750 miles per decade and 75 miles per year. Storm-proofing conducted as part of THPs will count towards the yearly and per-decade totals. Storm-proofing completed to the standards identified in Weaver and Hagans (1994) prior to issuance of the incidental take permit also count towards the first decade totals. Roads that are closed or decommissioned according to the standards in Weaver and Hagans (1994) are also considered storm-proofed and can be counted towards the yearly and per-decade totals. When used in this Plan, the term storm-proofing describes a process which involves the following elements:

1. The assessments follow the Pacific Watershed Associates protocols (July 1998 Draft HCP, Volume II, Part O, with Attachments). Generally, a trained observer walks a road segment looking for actual or potential occurrences of erosion, slippage, mass wasting, blocked or perched culverts, or other potential sediment sources. The assessment documents instances of Humboldt crossings, unstable fill slopes for roads and lands, water crossings that have a moderate to high potential for culvert blockage and/or diversion of stream flows onto the road bed, sufficient drainage and diversions of road drainage directly into the waters.

2. The likelihood that each identified feature will deliver sediment to waters also evaluated as part of the road assessment, as is total volume of sediment that could be prevented from delivery if remedial action is taken or not.

3. Based on the volume of sediment saved and likelihood of delivery, sites are assigned a high, medium or low priority.

4. All high and medium priority sites are scheduled for corrective action. Corrective action typically requires an excavator, bulldozer, and one or more dump trucks to dig up and replace water crossings, install drainage structures, remove unstable fill, alter the road bed to reduce the potential for diversion of flows onto the road surface, and the installation of rolling dips and/or water bars to route water and sediment.

5. All high and medium sites will be storm-proofed within five years of completion of the assessments, with all storm-proofing completed within 20 years of the issuance of the incidental take permit.

6. Storm-proofing will be completed on 750 miles within the first decade and 750 miles in the second decade. At least 75 miles of existing road will be storm-proofed per year. PALCO can request from NMFS, in writing, an exemption from the 75 miles per year requirement based on lack of work time due to atypical summer wet weather patterns or the repair of an unusually high number of water crossings. Exemption will be granted on showing of good cause.
7. To the extent feasible given logistics and cost of moving equipment, PALCO will storm-proof the worst sites, i.e. those most likely to fail or deliver the greatest volume of sediment to waters, in the first 10 year period. In addition, the very highest priority sites, i.e. those at risk of imminent failure which would deliver significant amount of sediment to waters will be storm-proofed in the first 3 years.

8. Storm-proofing shall be conducted between May 2 - October 14, subject to the following standards (these standards are the same for road construction/reconstruction/upgrade standards between June 2 – October 14):

- From May 2 to October 14 road storm-proofing shall not occur during periods of rainfall of 0.25 inches or greater during a 24-hour period or less. Operations shall cease and not resume until and unless soil moisture conditions, in soil moved for the purposes of construction and reconstruction, are no wetter than is found during normal watering (dust abatement) treatments or light rainfall , and is not rutting or pumping fines. Operations shall not result in a visible increase in turbidity in any drainage facility, on any construction/reconstruction site, or road surface, any of which drain directly to a Class I, II or III waters. Standing water on the road which does not drain to a Class I, II, or III, is not applicable.

9. Storm-proofing shall cease during the period between October 15 - May 1 (note the May 1 end date is different than the road construction/reconstruction end date of June 1), except for the following:

    - After October 15 specific storm-proofing treatments, listed below, can continue until the first storm of 0.25" or greater in a 24 hour period or less. The storm-proofing treatments permitted during this period are:

        - Installation of rolling dips and water bars
        - Armoring culvert inlets and outlets
        - Armoring unstable road fill
        - Rocking road surfaces

    - After the first storm as defined above, all storm-proofing treatments shall comply with the road construction/reconstruction/upgrading wet weather period standards until May 1. After May 1, item # 2.8 applies.

10. Road fill and actively eroding slopes that can be demonstrated as high risk of immediate failure which may deliver sediment to waters can be treated between October 15 - May 1.

11. Storm-proofing is considered complete when the specified corrective actions are complete, and the roads database and GIS system are updated to show that the subject road has been storm-proofed. The roads database will display where the treatments occurred, the extent (e.g. milepost) and type of treatment.

3) Road Construction, Reconstruction, and Upgrades

1. For purposes of this Plan, a road will be considered upgraded when it is well drained and shows no signs of imminent failure (e.g., as evidenced by slumping scarps or cracks in the road fill) which would deliver sediment to a waters. Actions necessary to upgrade a road include the installation of ditch relief culverts and/or rolling dips where significant downcutting of the

ditch is noted and removal or stabilization of unstable fill material at sites showing signs of imminent failure which could impact waters. An upgraded road, as described above meets the definition used in the Plan of "complying with the specifications described in the Handbook for Forest and Ranch Roads (Weaver and Hagans, 1994.)"

Road upgrades differ from road storm-proofing in that upgrades are not required on a specified schedule, are not necessarily identified through a sediment sources assessment, are not tracked on a database, and may not be as extensive as storm-proofing.

2. All THP related roads and landings shall be upgraded, as defined above, or closed or decommissioned, as per Weaver and Hagans (1994). THP related roads and landings are defined as those within the THP boundary and appurtenant to the THP area within the planning watershed(s) where the THP occurs. This road upgrading and closure shall result in sufficient sediment reduction in the planning watershed(s) to offset sediment production from the THP. The sediment reduction requirement remains in effect until a completed watershed analysis indicates that sediment is no longer causing an adverse impact to the aquatic environment.

3. All new and reconstructed roads will be built to site-specific storm-proof specifications as described by Weaver and Hagans (1994).

4. For all new roads and reconstructed water crossings, structures over fish-bearing and restorable fish-bearing waters will be designed to provide for unimpeded fish passage. This could involve use of bottomless or baffled culverts, bridges, or other such structures. Where culverts are used they will be installed at an appropriate gradient, be sized to permit passage of a 100-year recurrence interval flood without overtopping the culvert, and shall maintain a stream bed to ensure that the culverts are passable for fish, and to prevent culvert "perching." Fish passage will be ensured by adhering to standards for culvert installation developed by NMFS, or by NMFS review and approval of alternate installation measures.

5. Roads shall be constructed or reconstructed as single-lane with periodic turnouts. Roads shall be no more than 12 to 14 feet wide. Periodic turnouts, combined with road width, may extend out to a total of 18 ft.

6. New and reconstructed roads and landings shall be located outside riparian management zones except for RMZ crossings, which shall be minimized.

7. Roads shall be constructed or reconstructed by outsloping, maintained with rolling dips, or ditched roads maintained by a well-spaced ditch relief system.

8. Road drainage structures and facilities shall be spaced at appropriate intervals such that surface flow originating from the road surface and ditch does not create a gully or sediment plume that connects with the channel network.

9. Roads which utilize an inside ditch shall have ditch relief culverts spaced at intervals no greater than that specified in Weaver and Hagans (1994).

10. New, reconstructed and upgraded road-water crossings shall be constructed such that they do not have the potential to divert flows down the road or inside ditch.

11. No roads or landings will be constructed or reconstructed across inner gorges, headwall swales, unstable areas or areas having a high, very high or extreme mass wasting hazard rating, except as approved following the mass wasting avoidance strategy. Refer to the mass wasting avoidance strategy for road standards pre- and post- watershed analysis.

12. Road or landing construction, reconstruction and upgrades shall not occur during the wet weather period, defined for this purpose as October 15 - June 1, unless the following conditions are met:

    - no road or landing construction, reconstruction and upgrading within 170' of Class I or II waters, or within the Equipment Exclusion Zone (EEZ) (50' or 100', respectively) of Class III waters, and

    - the construction, reconstruction and upgrading shall not/will not cross Class I, II or III water, and

    - no portion of the constructed, reconstructed, and upgraded road/landing shall cross an inner gorge, headwall swale, unstable area, extreme, very high or high mass wasting hazard area, and

    - the soil moisture condition in the soils moved for purposes of construction, reconstruction and upgrading shall be no wetter than is found during normal watering (dust abatement) treatments or light rainfall, and is not rutting or pumping fines, and

    - during and after construction, reconstruction, and upgrading there shall be no visible increase in turbidity in any drainage facility, on any construction/reconstruction site, or road surface, any of which drain directly to Class I, II or III waters (standing water on the road that does not drain to Class I, II, or III, is not applicable), and

- during construction, reconstruction, and upgrading erosion control material of sufficient quantity, shall be stockpiled on site and utilized to prevent an increase in turbidity in any drainage facility, on any construction/reconstruction site, or road surface, any of which drain directly to Class I, II or III waters.

13. From June 2 to October 14 (the period outside of the wet weather period) road or landing construction, reconstruction and upgrades shall not occur during periods of rainfall of 0.25 inches or greater during a 24-hour period or less. Operations shall cease and not resume until and unless soil moisture conditions, in soil moved for the purposes of construction and reconstruction, are no wetter than is found during normal watering (dust abatement) treatments or light rainfall , and is not rutting or pumping fines. Operations shall not result in a visible increase in turbidity in any drainage facility, on any construction/reconstruction site, or road surface, any of which drain directly to Class I, II or III waters. Standing water on the road which does not drain to Class I, II, or III, is not applicable.

14. Road fill and actively eroding slopes that can be demonstrated as high risk of immediate failure which may deliver sediment to waters can be upgraded between October 15 - June 1.

15. A federal permit violation has not occurred if an activity that results in an unavoidable input of sediment to waters occurs, even though all wet weather and construction/reconstruction requirements were properly followed in addition to all required erosion control measures being properly installed. This does not relieve PALCO of any other requirements under other applicable federal and state laws.

4) Road Maintenance

1. Permanent roads through RMZs shall be treated and maintained with rock, chip seal or pavement. This includes water crossings and approaches.

2. Proper surface drainage configuration of the road (e.g. outsloping) will be maintained during maintenance activities.

3. Inboard ditches will be maintained (e.g. blading) only where blockage or insufficient capacity occurs.

4. Routine corrective work that will prevent diversion of water from a watercourse or ditch (e.g. repair to inside ditches, cross drains, water bars, road surface, unblocking of culverts, etc.) will be performed as soon as conditions permit, consistent with federal and state law, regardless of the time of year.

5. Maintenance needs, other than stated in the previous bullet, identified between June 1 to October 15 will be performed prior to October 15. Maintenance needs, other than stated in the previous bullet, identified after October 15 and prior to June 1 will be performed after June 1.

5) Road Inspections

1. All THP roads, including drainage facilities and landings, will be inspected annually for 5 years after operations, at a minimum.

2. All roads shall be inspected at least once annually after June 1 and prior to October 15 to ensure that drainage structures and facilities are in proper condition. This includes all improperly abandoned roads according to the definition provided by Weaver and Hagans (1994).

3. All roads shall be inspected again at least once during January or February, as soon as conditions permit access, following a storm event of 3" or greater in a 24-hour period or less. Multiple inspections during the winter period (October 15 - May 1) are encouraged, but only one inspection is required during January or February.

4. Roads and landings that cannot be inspected during any one of the annual inspections, after June 1 and before October 15, must be closed or decommissioned according to guidelines provided by Weaver and Hagans (1994). This work must be conducted within the same timelines as the storm-proofing.

5. Closed and decommissioned roads will be inspected after the first 5 year storm event or 5 years after completion of work, whichever comes first, to ensure that treatments to restore natural drainage and hillslope stability are functioning as intended. If treatments are found to be ineffective, further treatments shall occur if the volume of sediment prevented from entering a channel by additional treatments is greater than that incurred by re-entering the site.

6. Annual logs documenting inspection efforts will be provided to the Wildlife Agencies and CDF on the same schedule as the monitoring reports.

6) Wet Weather Road Use Restrictions

1. All road use is permitted when the road is dry, see definition below.

2. Except as provided below, all use of non-paved roads shall cease during periods when precipitation is sufficient to generate overland flow off the road or capable of leaving the road. Once road use has ceased due to forgoing conditions, use shall not resume until and

unless the road surface is dry. A dry road is that which moisture is less than or equal to that found during normal watering (dust abatement) treatments or light rain and is not rutting or pumping fines causing a visible increase in turbidity in a drainage facility or road surface, any which drain directly to Class I, II or III waters. This provision shall be applied according to a rule of reasonableness, and shall not prohibit, for example, use of a small segment of wet road of an otherwise dry road. If any permitted use results in damage to the road surface, drainage facilities, water bars or stream crossings the damage will be repaired within 24 hours after the initial damage occurred to eliminate the likelihood of related sediment reaching Class I, II, or III waters.

3. Consistent with federal and state law and regulation, in order to prevent or minimize significant adverse effects to the aquatic resource, emergency access is allowed during periods of wet weather in order to correct emergency road related problems, in the form of blocked culverts, imminent road fill failure, other erosion problems, and emergency human safety situations.

4. On rocked roads, light vehicles (defined as trucks 3/4 ton or less, or smaller vehicles such as quadra-tracs or motorcycles) may be used during periods of wet weather. If the use of rocked roads results in road related damage to the road surface, drainage facilities, water bars or water crossings, the damage will be repaired using hand tools within 24-hours after the initial damage has occurred, to eliminate the likelihood of related sediment reaching Class I, II, or III waters.

5. On non-rocked roads, light vehicles (defined as trucks 3/4 ton or less, or smaller vehicles such as quadra-tracs or motorcycles) may be used during periods of wet weather 48 hours after the cessation of precipitation if:

   - the light vehicle use is for timber related operations only, including felling and bucking, reforestation, wildlife and fisheries surveys, research and monitoring, erosion inspections, etc.

   - any damage caused by light vehicle use to the road surface, drainage facilities, water bars or water crossing will be repaired using hand tools within 24-hours after the initial damage has occurred to eliminate the likelihood of related sediment reaching Class I, II or III waters. At no time should the damage be to such an extent that heavy equipment is required for remediation.

7) Hillslope Management

The hillslope management-mass wasting strategy applies to all portions of PALCO's ownership, including RMZs. The prescriptions in the RMZs for mass wasting will not be less restrictive than the riparian prescription developed as part of watershed analysis, as appropriate and applicable to

this Plan. The hillslope management prescriptions may be modified as a result of watershed analysis.

1. PALCO shall not harvest, including sanitation salvage, exemption harvest and emergency timber operations, on mass wasting areas of concern, defined as areas of extreme mass wasting hazard, very high mass wasting hazard, high mass wasting hazard, inner gorges, headwall swales and unstable areas, including those within the RMZs on Class I, II and III waters. This restriction may be modified as a result of watershed analysis.

2. Except as described below, PALCO will not construct or reconstruct roads across mass wasting areas of concern, defined as areas of extreme mass wasting hazard, very high mass wasting hazard, high mass wasting hazard, inner gorges, headwall swales and unstable areas, prior to watershed analysis.

   - Newly constructed and reconstructed roads (not including storm-proofing) on mass wasting areas of concern (defined above) may be permitted prior to watershed analysis if PALCO provides the following:
     - a map of the mass wasting areas of concern overlayed by all existing roads, all proposed new construction and reconstruction on a planning watershed scale for a 1 year timeframe or longer
     - a geologic analysis of the risk of hillslope failure by the proposed new construction and reconstruction

   - All the information will be provided to the Wildlife Agencies who will make a determination if all, some or none of the proposed road construction or reconstruction will be permitted across the mass wasting areas of concern. This determination will be based on the proposed road locations, road specifications and the likelihood of avoidance of significant adverse impacts to covered species. The Wildlife Agencies will work cooperatively to provide consistent determinations to PALCO within 60 days after receipt of the maps and geologic reports as described above. If any of the Wildlife Agencies determines that the proposed road construction/reconstruction will not be permitted, that agency will work cooperatively with PALCO and the other Wildlife Agencies to develop feasible alternative road locations and/or road specifications or other access methods that will avoid significant impacts to covered species.

3. After watershed analysis roads may be constructed or reconstructed across inner gorges, unstable areas, headwall swales or areas having a high, very high or extreme mass wasting hazard rating if the watershed analysis determines that roads across these areas are appropriate. This watershed analysis determination shall include, but is not limited to, an assessment of risk to the aquatic environment by qualified wildlife agency aquatic biologist(s) or aquatic biologists acceptable to the Wildlife Agencies. If the watershed analysis determines that roads in these areas are appropriate, the proposed roads and road

specifications shall be evaluated, at the time of road design, by qualified professional geologist(s), including, but not limited to, certified engineering geologist(s) licensed by the State of California. The geologist(s) must make a determination that a road and the road specifications are sufficient to result in a stable road prism that is not likely to trigger or exacerbate mass wasting.

4. Road storm-proofing, road closure and road decommissioning of existing roads are acceptable and encouraged on the mass wasting areas of concern (identified above).

5. Before and/or after watershed analysis, the mass wasting areas of concern can be further defined on the ground [ground-truthed] with respect to the area boundaries [size] as part of individual THPs. This refinement shall be conducted by the California Department of Mines and Geology or a qualified professional geologist, including but not limited to, certified engineering geologists licensed by the State of California.

6. The ~50,000 acre area that has not yet been characterized for mass wasting, shall be treated in the interim, prior to characterization, as a mass wasting area of concern and shall be correctly characterized with defined boundaries on a THP basis using the same process as used for the entire ownership or in watershed analysis. The characterization will be conducted by the California Department of Mines and Geology or a qualified professional geologist, including but not limited to, certified engineering geologists licensed by the State of California.

7. The Wildlife Agencies and PALCO will jointly established a scientific panel to evaluate the definitions of high, very high and extreme mass wasting areas of concern. The panel may modify the definitions. The high, very high and extreme mass wasting areas of concern will be re-delineated for the entire ownership in accordance with any modified definitions.

8. The federal agencies, in consultation with state agencies, will provide a set of criteria for whether mass wasting events are to be considered "significant" for aquatic resources for use in the mass wasting watershed analysis module.

9. Definitions of mass wasting areas of concern:

    - Inner Gorge - that area of a watercourse bank situated immediately adjacent to the watercourse channel, having side slope of 65% or greater and extending from the edge of the channel upslope to the first break in slope (a break in slope is defined as a slope <65% for a distance of 100 ft. or more) above the watercourse channel.

- Unstable Area - characterized by slide areas or by some or all of the following: hummocky topography consisting of rolling bumpy ground, frequent benches, and depressions; short irregular surface drainages begin and end on the slope; tension cracks and head wall scarps; slopes are irregular and may be slightly concave in upper half and convex in the lower half from previous slope failure; evidence of impaired ground water movement resulting in local zones of saturation within the soil mass which is indicated at the surface of sag ponds with standing water, springs, or patches of wet ground. Some or all of the following may be present: hydrophytic vegetation prevalent; leaning, jackstrawed or split trees are common; pistol butted trees with excessive sweep may occur in areas of hummocky topography (leaning and pistol butted tress should be used as indicators of unstable areas only in the presence of other indicators).

- Headwall Swale - a concave depression, with convergent slopes of 65% or greater that is connected to waters via a continuous linear depression (a linear depression interrupted by a landslide deposit is considered continuous for this definition).

- High, Very High, and Extreme Mass Wasting Hazard Areas - refer to the July 1998 Draft HCP, Volume II, Part D Landscape Assessment of Geomorphic Sensitivity for the sensitivity ratings and Volume V, Map 13.

8) Measures to Minimize Surface Erosion in Riparian Areas

1. Within RMZs and EEZs, PALCO will treat all sites of exposed mineral soils, that are caused by forestry activities, if they are equal to or greater than 100 sq. ft. Treatments may include revegetation or other erosion control measures including, but not limited to, seeding and mulching.

2. Within RMZs and EEZs, PALCO will treat all sites of exposed mineral soils, on hillslopes greater than 30%, if the site can deliver fine sediment to waters. Treatments may include revegetation, or other erosion control measures including, but not limited to, seeding and mulching.

3. Water crossings will also be treated to avoid or minimize sediment delivery, using watershed analysis and/or road storm-proofing protocols to determine the appropriate treatments to be used on all such crossings.

4. Cable corridors that divert or carry water away from natural drainage pattern or channelize run-off that reaches waters shall have waterbreaks installed at intervals as per skid trail prescriptions by Weaver and Hagans (1994).

d. Aquatic Habitat Conservation

1) Measures for Timber Operations

Channel Migration Zone. CMZ evaluation and mapping will be conducted as part of the watershed analysis process. All segments of Class I and II waters that have a Rosgen (1996) type C, D or E channel morphology will be examined to identify the current boundaries of the CMZ. The CMZ boundary generally corresponds to the modern floodplain, but may also include river terraces that are subject to significant bank erosion. The CMZ is the area adjacent to watercourse constructed by the river in the present climate and inundated during periods of high flow. The floodplain is delineated by either the flood-prone area or the 100-year floodplain, whichever is greater (Rosgen 1996).

Prior to watershed analysis, areas must be analyzed and the CMZ delineated by PALCO on a THP basis using a qualified fluvial geomorphologist before any THP, including appurtenant roads, situated upslope of a channel with C, D, or E morphology can be approved. NMFS, CDFG, USFWS and EPA or NCRWQCB will be consulted regarding any such mapping.

a) Within CMZs

CMZs prescriptions may be modified as a result of watershed analysis.

1. PALCO shall not harvest, including sanitation salvage, exemption harvest and emergency timber operations, in the CMZ.

2. In cases of emergencies that could result in the loss of life or property and as per prior agreement with the Wildlife Agencies, harvest may be allowed in the CMZ. Loss of property is defined as a demonstrated high risk of loss of capital improvements such as bridges, roads, culverts, and houses, however it does not include the loss of vegetation.

Class I RMZs. All fish bearing (or restorable) Class I waters will have a Riparian Management Zone (RMZ). The RMZ for Class I waters is divided into two bands, the No-Harvest Band and the Outer Band. The bands are measured from 0 ft. to 100 ft, and 100 ft. to 170 ft., respectively, from the watercourse transition line, as defined by the FPRs (14 CCR 895.1) or outer edge of the CMZ (see below). Class I RMZ prescriptions may be modified as a result of watershed analysis.

Prescriptions for the Entire Class I RMZ

1. The RMZ measures 170 feet (slope distance) from the watercourse transition line or the outer CMZ edge (if a CMZ is present) on each side of the watercourse. Willows shall not be considered permanent vegetation for the purpose of determining the vegetation transition line.

2. No sanitation salvage, exemption harvest, or emergency timber operations (as defined and allowed in the FPRs) shall occur in the RMZ, except as per prior agreement with the Wildlife Agencies in accordance with the approved HCP.

3. All portions of down wood (i.e., LWD), except as defined as slash in the FPRs, will be retained.

4. Trees felled during current harvesting operations and THP-approved road construction are not considered down wood for purposes of retention.

5. Felled hazard trees or snags not associated with a THP are considered down wood and are to be retained in the general vicinity.

6. Trees that fall naturally onto roads, landings, or harvest units within the RMZ are considered down wood and are to be retained in the general vicinity.

7. All non-hazard snags will be retained, as per the snag policy in the HCP.

8. The RMZ is an equipment exclusion zone (EEZ) for timber operations, except for roads and permitted equipment crossings.

9. Full suspension yarding will be used when feasible. Full suspension is not feasible on flat ground, in other sites with limited deflection, where an adjacent landowner will not provide permission to secure a cable, or where a full suspension yarding system would jeopardize the safety of field personnel. For these conditions, yarding will be conducted in a manner that avoids ground disturbance that may deliver sediment to waters to the maximum extent practicable. Where ground disturbance occurs PALCO will treat (e.g., through seeding, mulching, etc.) all sites with exposed mineral soil that can reasonably be expected to deliver sediment to waters (e.g., gullies, ruts).

10. Trees not marked for harvest may be felled within the RMZ to provide safety clearance for cable yarding corridors. Such felling will be done only as needed to ensure worker safety. In such cases, to the extent possible given site conditions and the FPRs, trees will be felled toward the waters to provide LWD and will be identified in THPs as an In Lieu Practice

(14 CCR 916.1). Regardless, trees felled within the RMZ for safety purposes will be retained as down wood.

11. Trees not marked for harvest which are damaged in the cable yarding corridors must be retained in place, either standing or as down wood.

12. There will be a maximum of 1 entry every 20 years.

13. If any area within the RMZ, including the 50% slope provision band, falls within the boundary of a mass wasting area of concern, then the mass wasting strategy applies for that area.

Prescriptions for Class I No Harvest Band, 0 ft. to 100 ft.

1. No harvest, including sanitation salvage, exemption harvest, or emergency timber operations, shall occur in the No Harvest Band.

2. Road segments within the first 30 ft. of the No Harvest Band must be mitigated by extending the No Harvest Band on the opposite side of the waters from the existing road an equivalent distance of that portion of the road prism within the No Harvest Band. In the case of RMZ road crossings, the first 50 ft of road extending inland from the watercourse transition line is exempt from this mitigation.

Prescriptions for the Late Seral Class I Outer Band, 100 ft. to 170 ft.

1. Only single-tree selection will occur within the Outer Band.

2. Harvest will only occur in the Outer Band if there is a preharvest conifer basal area of 276 sq ft per acre or greater within the Outer Band on each side of the waters.

3. A minimum 240 sq ft post-harvest conifer basal area per acre within the Outer Band will be retained on each side of the waters.

4. No more than 40 percent of the conifer basal area may be harvested in a single entry.

5. Tree size and quantities shall be retained per Table 17 (July 1998 Draft HCP, Volume I). Larger tree size classes (including those larger than 40") shall be used for replacement if stated size classes are not present.

6. Basal area measurements will be made for conformance every 200 ft lineal segment of RMZ. Surface area covered in roads and landings will be included in all calculations of basal area.

7. 50% Steep Slope Provision: For all slopes 50% and greater adjacent to the RMZ, the RMZ Outer Band prescriptions, at a minimum, shall be extended upslope to the break in slope (defined as a slope <50% for a distance of more than 100 ft.) or upslope to a slope distance of 400 ft. measured from the watercourse transition line or the outer edge of the CMZ, whichever is greater.

Class II RMZs. All non-fish bearing Class II waters will have a Riparian Management Zone (RMZ). The RMZ for Class II waters is divided into two bands, the No-Harvest Band and the Selective Entry Band. The bands are measured from 0 ft. to 30 ft, and 30 ft. to 130 ft., respectively, from the watercourse transition line or outer edge of the CMZ (see below). Class II RMZ prescriptions may be modified as a result of watershed analysis.

Prescriptions for the Entire Class II RMZ

1. The RMZ is 130 ft. (slope distance) from the watercourse transition line or the outer CMZ edge (if a CMZ is present) on each side of the waters. Willows shall not be considered permanent vegetation for the purpose of determining the watercourse transition line.

2. No sanitation salvage, exemption harvest, or emergency timber operations (as defined and allowed in the FPRs) shall occur in the RMZ, except as per prior agreement with the Wildlife Agencies in accordance with the approved HCP.

3. All portions of down wood (i.e., LWD), except as defined as slash in the FPRs, will be retained.

4. Trees felled during current harvesting operations and THP-approved road construction are not considered down wood for purposes of retention.

5. Felled hazard trees or snags not associated with a THP are considered down wood and are to be retained in the general vicinity.

6. Trees that fall naturally onto roads, landings, or harvest units within the RMZ are considered down wood and are to be retained in the general vicinity.

7. All non-hazard snags will be retained, as per the snag policy in the HCP.

8. The RMZ is an equipment exclusion zone (EEZ) for timber operations, except for roads and permitted equipment crossings.

9. Full suspension yarding will be used when feasible. Full suspension is not feasible on flat ground, in other sites with limited deflection, where an adjacent landowner will not provide

permission to secure a cable, or where a full suspension yarding system would jeopardize the safety of field personnel. For these conditions, yarding will be conducted in a manner that avoids ground disturbance that may deliver sediment to waters to the maximum extent practicable. Where ground disturbance occurs PALCO will treat (e.g., through seeding, mulching, etc.) all sites with exposed mineral soil that can reasonably be expected to deliver sediment to waters (e.g., gullies, ruts).

10. Trees not marked for harvest may be felled within the RMZ to provide safety clearance for cable yarding corridors. Such felling will be done only as needed to ensure worker safety. In such cases, to the extent possible given site conditions and the FPRs, trees will be felled toward the waters to provide LWD and will be identified in THPs as an In Lieu Practice (14 CCR 916.1). Regardless, trees felled within the RMZ for safety purposes will be retained as down wood.

11. Trees not marked for harvest which are damaged in the cable yarding corridors must be retained in place, either standing or as down wood.

12. There will be a maximum of 1 entry every 20 years.

13. If any area within the RMZ, including the 50% steep slope provision band and the sediment filtration band, falls within the boundary of a mass wasting area of concern, then the mass wasting strategy applies for that area.

<u>Prescriptions for Class II No Harvest Band, 0 ft. to 30 ft.</u>

1. No harvest, including sanitation salvage, exemption harvest, or emergency timber operations, shall occur in the No Harvest Band.

2. Road segments within the No Harvest Band must be mitigated by extending the No Harvest Band on the opposite side of the waters from the existing road an equivalent distance of that portion of the road prism within the No Harvest Band. In the case of RMZ road crossings, the first 50 ft of road extending inland from the watercourse transition line is exempt from this mitigation.

<u>Prescriptions for the Late Seral Class II Selective Entry Band, 30 ft. to 130 ft.</u>

1. Only single-tree selection will occur within the Selective Entry Band.
2. Harvest will only occur in the Selective Entry Band if there is a preharvest conifer basal area of 276 sq ft per acre or greater within the Selective Entry Band on each side of the waters.

3. A minimum 240 sq ft post-harvest conifer basal area per acre within the Selective Entry Band will be retained on each side of the waters.

4. No more than 40 percent of the conifer basal area may be harvested in a single entry.

5. Tree size and quantities shall be retained per Table 17 (July 1998 Draft HCP, Volume I). Larger tree size classes (including those larger than 40") shall be used for replacement if stated size classes are not present.

6. Basal area measurements will be made for conformance every 200 ft lineal segment of RMZ. Surface area covered in roads and landings will be included in all calculations of basal area.

7. 50% Steep Slope Provision: For all slopes 50% and greater adjacent to the RMZ, the RMZ Selective Entry Band prescriptions, at a minimum, shall be extended upslope to the break in slope (defined as a slope <50% for a distance of more than 100 ft.) or upslope to a slope distance of 400 ft. measured from the watercourse transition line or the outer edge of the CMZ, whichever is greater.

8. For all slopes <50% adjacent to the RMZ, a sediment filtration band shall be established from 130' - 170'. Within this band all down wood shall be retained, except slash, fire ignition is prohibited and the band is an EEZ.

Class III RMZs. All Class III waters will have a Riparian Management Zone (RMZ). The RMZ for Class III waters is divided into two bands. The RMZs are measured 0 ft. to 50 ft. for slopes less than 50% and 0 ft. to 100 ft. for slopes 50% and greater, measured from the watercourse transition line. Class III RMZ prescriptions may be modified as a result of watershed analysis.

Prescriptions for All Class III RMZs

1. A scientific, statistically valid, study will be designed by an independent party jointly selected by PALCO and the Wildlife Agencies to address questions put forward by PALCO and the Wildlife Agencies regarding Class III input of sediment and large wood and the effectiveness of different prescriptions.

2. If any area within the RMZ falls within the definition of a mass wasting area of concern, then the mass wasting strategy applies.

3. All RMZ width requirements stop at the hydrologic divide.

4. All areas are EEZs for timber operations, except for roads and permitted equipment crossings. All tractor road water crossings must be flagged on the ground prior to the pre-

harvest inspection and shown on the THP map in order to be adequately evaluated for the potential to generate sediment.

5. Skid trails shall be stabilized as per the 1998 California Forest Practice Rules, per an approved THP in accordance with the Class I/II standard.

6. All down wood and debris shall be retained within the EEZs, except for cases of emergency as per agreement with the Wildlife Agencies.

7. All down wood and debris in the channel shall be retained.

8. Trees felled during current harvesting operations and THP-approved road construction are not considered down wood for purposes of retention.

9. Felled hazard trees or snags not associated with a THP are considered down wood and are to be retained in the general vicinity.

10. Trees that fall naturally onto roads, landings, or harvest units within the RMZ are considered down wood and are to be retained in the general vicinity.

11. Full suspension yarding will be used when feasible. Full suspension is not feasible on flat ground, in other sites with limited deflection, where an adjacent landowner will not provide permission to secure a cable, or where a full suspension yarding system would jeopardize the safety of field personnel. For these conditions, yarding will be conducted in a manner that avoids ground disturbance that may deliver sediment to waters to the maximum extent practicable. Where ground disturbance occurs PALCO will treat (e.g., through seeding, mulching, etc.) all sites with exposed mineral soil that can reasonably be expected to deliver sediment to a waters (e.g., gullies, ruts).

12. Trees not marked for harvest may be felled within the RMZ to provide safety clearance for cable yarding corridors. Such felling will be done only as needed to ensure worker safety. In such cases, to the extent possible given site conditions and the FPRs, trees will be felled toward the waters to provide LWD and will be identified in THPs as an In Lieu Practice (14 CCR 916.1). Regardless, trees felled within the RMZ for safety purposes will be retained as down wood.

13. Trees not marked for harvest which are damaged in the cable yarding corridors must be retained in place, either standing or as down wood.

14. PALCO shall not harvest in the 0 ft. to 30 ft. band, with the exception of a maximum of one entry, prior to watershed analysis, into 1400 acres for harvest (identified in #16) and 775 acres for commercial thinning (identified in #17).

15. No sanitation salvage, exemption harvest, or emergency timber operations is allowed in the 0 ft. - 30 ft. band.

16. Subject to all other applicable HCP requirements and watershed analysis, harvesting is permitted on the 1400 acres of mid-successional and late seral vegetation types identified in the Sustained Yield Plan over the first 5 years in the 0 ft.- 30 ft. band, following the standards below:

- one harvest entry, maximum, prior to watershed analysis
- 0 ft. to 10 ft. no harvest for protection of the channel and bank
- maximum removal of 1/3 conifer basal area per 200 linear ft.
- harvesting will be distributed across all diameter classes
- trees removed for a road, skid trail or cable corridor will be counted towards the maximum volume and basal area calculations
- all sub and non-merchantable conifers will be left standing on site if feasible
- no sanitation salvage, exemption harvest, or emergency timber operations

17. Subject to all other applicable HCP requirements and watershed analysis, commercial thinning is permitted on the 775 acres identified in the Sustained Yield Plan over the first 5 years in the 0 ft. - 30 ft. band, following the standards below:

- one thinning entry, maximum, prior to watershed analysis
- 0' - 10' no harvest for protection of the channel and bank
- maximum removal of 1/3 conifer basal area per 200 linear ft.
- thinning will be distributed across all diameter classes
- the site will be recaptured within 5-10 years
- trees removed for a road, skid trail or cable corridor will be counted towards the volume and basal area maximum
- all sub and non-merchantable conifers will be left standing on site if feasible
- no sanitation salvage, exemption harvest, or emergency timber operations

<u>Prescriptions for Class III Buffers with Slopes <50%</u>

1. No Harvest Band from 0 ft. to 30 ft. with the exception of the 1400 acre harvest and 775 acre commercial thinning identified previously.

2. Sediment Filtration Band from 30 ft. to 50 ft., apply all prescription identified above in items #1 through #13.

<u>Prescriptions for Class III Buffers with Slopes 50% and Greater</u>

1. No Harvest Band from 0 ft. to 30 ft., with the exception of the 1400 acre harvest and 775 acre commercial thinning identified previously.

2. Sediment Filtration Band from 30 ft. to 100 ft., apply all prescription identified above in items #1 through #13.

2) Burning

1. No fire ignition shall occur in the RMZs and EEZs. Fires ignition shall occur so fire will back its way toward the RMZs and EEZs.

2. PALCO shall only light fire on one side of the RMZ, at a time, if due to topographic features and/or fuel patterns, the likelihood that a fires lit on both sides of a RMZ would result in intrusion into the RMZ.

3. Burning is limited to spring and fall when fuel moisture conditions, relative humidity, fuel loading and atmospheric conditions , such as wind, are conducive to controlled burning.

4. Fuels breaks in the RMZ shall be avoided. Minimal hand clearing for fuel breaks in the RMZ may be conducted to prevent and control escaped fires. No overstory removal will be undertaken. If areas of bare soil are exposed from fuel breaks or fire that could result in fine sediment inputs into a Class I, II, or III waters, such areas will be treated as per the surface erosion requirements.

5. All burns are conducted pursuant to permits issued by CDF.

6. When available and feasible, a helitorch will be used to ignite fires for better directional and speed control of the fire.

3) Disturbance Index

1. As modified by the elements below, PALCO shall follow the process identified in the July 1998 Draft HCP, Volume II, Part E Assessment of Watershed Disturbances and Recovery.

2. The Disturbance Index and its elements may be modified as a result of watershed analysis, subject to approval by the Wildlife Agencies.

3. The Disturbance Index will be calculated at the hydrologic unit scale.

4. The Disturbance Index will be modified to account for all roads, distinct from other harvest activities.

5. Roads that are used or maintained at least once during the 10-year time factor will remain in the index calculation and the disturbance ratings will not diminish over time.

6. Roads that are improperly abandoned as per Weaver and Hagans (1994) definition will remain in the index calculation and the disturbance ratings will not diminish over time. Roads that are properly closed or decommissioned are not considered to be improperly abandoned.

7. The Disturbance Index will be modified to account for all mass wasting events (landslides, debris torrents, etc.), distinct from other activities and ratings.

8. The upper limit of the Disturbance Index is set at 20%.

9. The initial Disturbance Indices, as modified, will be calculated for the entire ownership, at the hydrologic unit scale, within 3 months of the issuance of the incidental take permit. PALCO shall submit this information to the Wildlife Agencies in a report form with the Disturbance Index and supporting calculations immediately following each hydrologic unit calculation. Subsequent calculations will be on a THP basis.

10. If the calculated index is at or above 20%, then PALCO shall refrain from all activities with the highest disturbance ratings, 0.7 and above, and can not increase the index from one THP to another. Activities shall be conducted in a manner that lowers the index on an annual basis and shall be at or below 20% within the 10-year time factor.

11. To ensure that Class I sub-basin salmonid populations are not extirpated in the hydrologic units that have a Disturbance Index in excess of 20%, PALCO shall apply the following restrictions until watershed analysis is complete and site specific information is generated on Class I sub-basins. In addition to the following operational restrictions, PALCO shall conduct only those actions that result in a decrease in the index in Class I sub-basins until the index drops below 20%:
    - no clearcut or rehabilitation harvest
    - full suspension skyline or helicopter yarding only
    - no new road construction or reconstruction
    - wet weather period operations (October 15 - June 1) are limited to erosion control maintenance, planting, falling and bucking, and full suspension yarding to landings outside the sub-basin
    - no broadcast burning
    - no skid trail or layout construction

- treat all areas of bare mineral soil outside of RMZs, EEZs, and ELZs created by timber operations of 400 square feet or any less than 400 square feet if the site can deliver sediment to a waters.
- no more than 50% of the basal area shall be removed in one entry.

12. If the index is below 20%, no activities will be conducted that will increase the index in excess of the 20% upper limit.

4) Measures for Other Plan Area Activities

Commercial Rock Quarries. Two commercial rock quarries are covered under the incidental take permit for a period ending on March 1, 2001. These two rock quarries are identified as Rock Quarry 1/Road 24 in the Yager Creek drainage and Rock Quarry 2/Road 9 in the Lawrence Creek drainage.

1. PALCO shall continue to use engineered detention ponds and erosion control to reduce impacts on waters and riparian areas.

2. PALCO shall implement appropriate mitigation so rock quarry operations do not result in a visible increase in turbidity in any drainage facility, work site, quarry area, etc, any of which drain to a Class I, II or III waters. Appropriate mitigation includes but is not limited to wet weather operating limitations, installation of sediment control structure, limitations on overburden placement and distribution, removal of spoil material, revegetation and abandonment.

3. The site specifics of the rock quarries and their effects at the hydrologic unit scale shall be evaluated during watershed analysis. Additional mitigation, identified above, may be implemented depending on the results of watershed analysis.

4. The Wildlife Agencies commit to work with PALCO to process an amendment to the HCP to continue coverage of the two rock quarries after expiration of the initial two year period.

Borrow Pits. Borrow pits are covered under the incidental take permit for a period of five years ending on March 1, 2004.

1. PALCO shall utilize the same mitigation requirements for borrow pits as is required for roads, including the prohibition on new borrow pits in the RMZs, prohibition on new borrow pits in the mass wasting areas of concern prior to watershed analysis, road construction/reconstruction standards and wet weather operations.

2. Borrow pits will be mapped and analyzed for site specific and hydrologic unit scale impacts as part of watershed analysis. Additional mitigation and minimization measures for borrow pits may be required as a result of watershed analysis. Additional mitigation may include, but is not limited, installation of sediment control structures, limitations on overburden placement and distribution, removal of spoil material, revegetation and abandonment.

3. The Wildlife Agencies commit to work with PALCO to process an amendment to the HCP to continue coverage of borrow pits after the expiration of the initial five year period.

Water Drafting

1. PALCO shall utilize the most current NMFS water drafting screen specifications. As of the Effective Date, the screen specifications described below are the most current and shall be used until they are replaced by NMFS.

2. The screen shall be kept in good repair and shall be used whenever water is drafting.

3. The screen face shall be parallel to the flow of the water.

4. The screen shall have an approach velocity of no more than 0.33 feet per second. The approach velocity is the velocity of the water through the screen openings.

    - The screen shall have at least 12 square feet of open area per cubic foot per second of the maximum diversion rate (12 sq. ft. of screen per 450 gal./min.).

    - Round openings shall not exceed 3/32" in diameter.
      Square openings shall not exceed 3/32" measured diagonally.
      Slotted openings shall not exceed 0.0689" in width (approx. 1/16")

5. The screen shall be cleaned as frequently as necessary to prevent the approach velocity from exceeding 0.33 feet per second and to prevent the head differential through the screen from exceeding 2".

6. The diversion rate shall not exceed inflow.

e. Aquatic Monitoring

PALCO's current aquatic monitoring, including compliance, effectiveness and trend, will be revised after each watershed analysis to respond to the specificity of prescriptions, assumptions and questions for each hydrologic unit.

PALCO is responsible for the cost of the monitoring program.

1) Compliance Monitoring

Compliance monitoring activities will contribute to the goal of achieving 100 percent prescription implementation. Compliance monitoring includes four components: third party monitoring, THP checklist, the Best Management Practice Evaluation Program and application of the compliance findings.

HCP Monitor. The HCP Monitor, as described in section F-13 shall have full access to PALCO's land, at all times, to inspect any Covered Activity, and shall be present on site during every timber harvest conducted by or on behalf of PALCO. The HCP Monitor shall also, at the request of the Wildlife Agencies, monitor the effectiveness of the aquatic conservation plan.

THP Checklist. PALCO resource professionals preparing THPs and timber harvest exemptions and agencies conducting the environmental review of PALCO's plans will be guided by the "Pacific Lumber Company Timber Harvest Plan Checklist". The checklist will be used to confirm that all relevant elements of the PALCO Aquatic Conservation Plan are contained in the THPs and made enforceable under the THPs. PALCO and the Wildlife Agencies will revise the checklist during watershed analysis to create a THP checklist for each watershed to ensure implementation of watershed-specific prescriptions.

Framework: Best Management Practice Evaluation Program. PALCO will also conduct compliance monitoring as part of the "Framework: Best Management Practice Evaluation Program" (example attached). PALCO shall use this approach to document how well the aquatic strategy prescriptions are being applied. This program sets criteria for determining which THPs will be monitored and integrates compliance monitoring requirements with effectiveness monitoring to minimize personnel costs and maximize efficiency.

Attached is an example of a worksheet and a description of an evaluation procedure developed for the Best Management Practice Evaluation Program (BMPEP) of the Pacific Southwest Region of United States Department of Agriculture, Forest Service (USDA Forest Service 1992). This procedure is also used in a modified form by the California Department of Forestry and Fire Protection. The program identifies 28 hillslope evaluation procedures for implementation and effectiveness monitoring. The approach specifies how to sample sites to be evaluated, the timing and frequency of evaluations, details on what factors are to be rated and others. This program has been the subject of an on-going review by the USDA Forest Service, the Environmental Protection Agency and State of California Water Resources Control Board.

The PALCO will use the BMPEP framework to develop watershed-specific implementation and hillslope effectiveness monitoring protocols. PALCO will draft a separate evaluation procedure for related sets of prescriptions in the Aquatic Conservation Plan, including those listed on the "THP

Checklist" (described above) and present each for review, revision and final approval by the Wildlife Agencies. As watershed analysis is completed for each hydrologic unit, revised sets of evaluation procedures will be developed following the BMPEP framework.

The elements of the compliance and hillslope effectiveness evaluation program and protocols will include:

1. Statement of required qualifications of those who will conduct the monitoring.
2. Database and data storage, retrieval and annual reporting requirements.
3. A procedure and criteria for developing a random sample pool of THPs and exemptions for each hydrologic unit from which THPs and exemptions are to be randomly selected and sampled.
4. A procedure and criteria for developing random sample pools of sites from among the randomly selected THPs and exemptions for each type of prescription to be evaluated for implementation and hillslope effectiveness.
5. A step-by-step procedure to identify sample site locations (e.g., for RMZs, roads, harvest units) and the timing (e.g., after the first winter storms) of implementation and hillslope effectiveness monitoring for each of the prescriptions.
6. For each evaluation procedure, detailed descriptions a) on how parameters are to be measured and b) of rating criteria.
7. Confirmation that the relevant prescriptions were made part of the THP or exemption.
8. Compliance and hillslope effectiveness monitoring evaluation in the field at the appropriate time using an evaluation form and rating criteria developed for each prescription.
9. Procedures for timely forwarding of completed field forms, filing of forms, data entry, and database management and reporting to the reviewing agencies.
10. Procedures for timely corrective actions.

Initially, all THPs and exemptions in each hydrologic unit and calendar year that meet selection criteria approved by the Wildlife Agencies will be subject to compliance and hillslope effectiveness monitoring. Examples of selection criteria include plans where hillslope best management practices pertaining to erosion control and RMZs have been "tested" by winter storms, plans with specific geologic concerns and others. PALCO and the Wildlife Agencies will develop selection criteria specific to the Aquatic Conservation Plan. Not every RMZ or road, however, in every THP and exemption need be evaluated. The individual random sample pools of sites for each related set of prescriptions will initially be comprised of at least 50 percent of the sites where the prescription are applied. The Wildlife Agencies, in consultation with PALCO, will decide whether this proportion of sites where prescriptions are applied will continued to be monitored. The decision will be based on the results of compliance and hillslope effectiveness monitoring presented in annual monitoring reports. In addition, the Wildlife Agencies will conduct quarterly audits of the compliance monitoring and annual audits of the hillslope effectiveness monitoring evaluations carried out by PALCO to help ensure monitoring protocols are being followed.

Application of Compliance Monitoring Findings. PALCO and the Wildlife Agencies shall identify recurring successes and problems with aquatic strategy prescription implementation by conducting: 1) quarterly reviews of the compliance monitoring reports, 2) hillslope inspections, 3) and audits of how PALCO includes the aquatic strategy prescriptions in THPs and follows monitoring procedures. Problems with implementation shall lead to remedies that will include but not be limited to: training of personnel, adjustments in registered professional forester's and licensed timber operators' oversight and supervision over contractors and field crews, changes in equipment, refinements of prescriptions and regulatory sanctions.

2) Effectiveness Monitoring

PALCO, with input from the Wildlife Agencies and from peer review panels, will craft hillslope effectiveness monitoring, instream effectiveness monitoring and trend monitoring strategies for each hydrologic unit. The exact details of what, where, when and how PALCO will be monitoring will be determined by questions and hypotheses posed by PALCO and the Wildlife Agencies. PALCO and the Wildlife Agencies will develop these monitoring objectives based on the findings of watershed analysis and other sources of assembled information.

PALCO will use effectiveness monitoring as a basis for evaluating the results of carrying out prescriptions on the features or processes that occur on the hillslope and on those in the instream environment. Hillslope effectiveness monitoring will help PALCO determine whether properly implemented prescriptions on the hillslope actually "work" (e.g., properly installed water bars actually prevented road surface rill erosion). Instream effectiveness monitoring will be used to determine whether the prescriptions result in protection of aquatic values (e.g., maintained or decreased percent of fine sediment in spawning riffles).

PALCO will monitor both instream and upslope conditions to assess the effectiveness of the Aquatic Conservation Plan. These effectiveness studies, in turn, will provide most of the impetus for the adaptive management component of the Plan.

Large Woody Debris and Riparian Buffers

PALCO will obtain baseline information on large woody debris (LWD) levels and recruitment potential from riparian stands during the watershed analysis process for each hydrologic unit as well as through on-going resource assessment efforts, including those of CDF&G. This information will also be collected as part of PALCO's trend monitoring program (discussed below). PALCO and the Wildlife Agencies will develop questions and hypotheses to be tested through compliance monitoring and hillslope and instream effectiveness monitoring while using this baseline information.

PALCO's hillslope effectiveness monitoring will determine whether forest stands within riparian buffers are developing increasing numbers of large trees. Information on stand conditions will be collected during THP preparation and review and through watershed analysis. As an initial

indication of the effectiveness of correctly implemented prescriptions applied to riparian buffers, PALCO will show that currently understocked riparian stands will develop sufficient basal area and large trees to permit harvest.

Water Temperature

PALCO will monitor water temperatures during instream effectiveness monitoring and trend monitoring. PALCO will monitor instream water temperatures to see if recorded values show an increasing or decreasing trend over time. Water temperature data will be collected for at least 5 years to determine initial trends. PALCO will also determine the effectiveness of the aquatic strategy for temperature by monitoring changes in canopy closure over waters.

Sediment

In conjunction with instream effectiveness monitoring and trends monitoring, PALCO will monitor data on instream sediment levels, channel morphology, stream bed aggradation/degradation, and biological metrics sensitive to sediment (e.g., invertebrate diversity).

PALCO will assess the effectiveness of the sediment control measures by monitoring sediment production rates from roads and hillslopes. PALCO will in this way detect any shortcomings in sediment control measures earlier than if the company depended only on instream conditions. PALCO will institute alternate management approaches to address identified shortcomings through the adaptive management process.

PALCO will conduct sediment source inventories as part of the watershed analysis process for each hydrologic unit. These studies will provide baseline data on the number, location, and size of sediment sources on the ownership. In addition, these studies will provide sediment budgets identifying the amount of sediment being delivered to waters from different sources. Within five years of completing the baseline sediment studies, PALCO will conduct follow up studies. These will determine the extent to which these sediment sources remain active and new sources develop (e.g., how many slides have occurred in the interim**),** their relationship to management activities, and how the rates of management-related surface erosion and landslides compare to the rates in the baseline period. PALCO will continue to inventory surface erosion within harvest units, bank erosion, new landslides and road related failures as they occur. These follow up studies will continue to be completed at five-year intervals in conjunction with the watershed analysis revisitations for the life of the PALCO Aquatic Conservation Plan.

Hillslope and instream effectiveness monitoring and trends monitoring will provide the necessary information for determining how the PALCO Aquatic Conservation Plan affects sediment delivery to waters. In addition, because the follow up studies will examine the relationship between management and sediment production, PALCO will use their results as guidance on how to modify management activities, if necessary, to reduce sediment production through the adaptive management process.

Sediment parameters are perhaps the most difficult on which to conduct effectiveness monitoring. Given this difficulty, PALCO will modify its approach for determining the effectiveness of sediment control measures as new data and scientific results become available.

Amphibian and Reptile Habitat and Population Monitoring

PALCO will work with the USFWS and CDF&G to develop an amphibian habitat module (e.g., for tailed frogs, southern torrent salamanders and foothill yellow legged frogs) to be implemented during watershed analysis. As this module is applied across PALCO's ownership, information that will help monitor the effectiveness of aquatic prescriptions to protect amphibians will become available.

PALCO and the agencies will conduct instream effectiveness monitoring to determine the adequacy of the aquatic strategy for amphibian species. For this purpose, PALCO will use the temperature, sediment and large wood information that will be collected on both Class I and II waters. PALCO will modify amphibian monitoring efforts as new data and scientific results become available.

Cost-benefit Effectiveness

Cost-benefit effectiveness studies are needed to determine whether the benefits of protective measures being implemented by PALCO in the field are proportional to the costs to the company. Similarly, such studies could identify alternate mitigation approaches that continue to protect resources but at lower costs to the company. At present, PALCO is generally able to identify the costs of specific mitigation measures with greater ease and certainty than it can identify the benefits of these measures to fish and wildlife. As PALCO obtains new information on the biological benefits of mitigation within the Aquatic Conservation Plan, PALCO will be able to more accurately assess the relationships between costs and benefits.

Hillslope Effectiveness Monitoring.

Framework: Best Management Practice Evaluation Program

Refer to the discussion above in regarding compliance monitoring for a description of the BMPEP.

Application of Hillslope Effectiveness Monitoring Findings

PALCO and the agencies will identify recurring successes and problems with the PALCO Aquatic Conservation Plan effectiveness on the hillslope by: 1) conducting annual reviews of the hillslope

effectiveness monitoring reports, 2) hillslope inspections, 3) and the audits of monitoring procedures. Problems with hillslope effectiveness may lead to modification of prescriptions through adaptive management.

Instream Effectiveness Monitoring. The overriding objective of instream effectiveness monitoring of the PALCO Aquatic Conservation Plan is to determine, in a timely manner, whether the prescriptions applied to the hillslope are effective in protecting and improving the condition of aquatic resources. If prescriptions are not effective, this should be determined by PALCO and the agencies, and the prescriptions should be modified as soon as possible to prevent unanticipated adverse effects, through adaptive management.

Instream effectiveness monitoring provides a means for assessing how individual prescriptions and management regimes as a whole are effective in protecting and restoring aquatic values. Instream effectiveness monitoring complements hillslope monitoring in providing a further basis for determining whether the prescriptions applied on the hillslope, including in riparian zones, are effective in controlling the rates and types of watershed inputs to waters. Because instream conditions integrate all watershed inputs, however, relating measurements of instream conditions to the effectiveness of individual prescriptions may be difficult (MacDonald and others 1991). Nevertheless, carefully designed instream effectiveness monitoring intended to answer specific questions can provide information that PALCO and the agencies can use to modify prescriptions and adapt management regimes to better protect water quality and aquatic species and their habitats.

Instream effectiveness monitoring, in contrast to trends monitoring, should be carried out as close as possible to where the impact mechanisms on the hillslope are at play. Instream effectiveness monitoring should occur in tributary waters, higher up in watersheds, or otherwise, in locations intimately linked to hillslope processes. Monitoring conducted in such locations holds the greatest promise for establishing timely feedback mechanisms through which PALCO and the agencies can identify which prescriptions or procedures are not effective in protecting and restoring aquatic values and then modify them through adaptive management.

Instream Monitoring Approach

PALCO will develop and implement, with the oversight and concurrence of the agencies, instream monitoring approaches for two contexts: 1) watersheds where watershed analysis has not been completed and 2) watersheds which have been or are the subject of watershed analysis. PALCO, in consultation with the agencies, will design general instream effectiveness monitoring approaches for the former using a combination of the following: baseline information compiled for the PALCO Aquatic Conservation Plan, other information as it becomes available through watershed studies, resources inventories and monitoring conducted or mandated by public agencies (e.g., CDFG, RWQCB, CDF and others), input from resource professionals familiar with conditions in the local watersheds and the public living in or near the watersheds to be monitored. While designing the approaches for instream effectiveness monitoring in watersheds subject to watershed analysis,

PALCO and the agencies will use these same information sources, however, the instream effectiveness monitoring designs will benefit from the focused watershed-specific assessments and syntheses that are integral components of watershed analysis. The PALCO will iteratively use these insights gained from the watershed analysis assessments and syntheses to design instream effectiveness monitoring elsewhere.

Instream Effectiveness Monitoring Objectives

All monitoring should be for the purpose of achieving focused objectives, answering specific questions or testing well-considered hypotheses. This is particularly true for instream effectiveness monitoring. The following are examples of mechanistic null hypotheses that illustrate the types of questions that PALCO will answer through its instream effectiveness monitoring program:

> Hypothesis: There is no significant increase in stream bank instability and scouring of Class III waters with gradients greater than three percent by the end of the first winter period after clearcutting through the application of Class III EEZ prescriptions.
>
> Hypothesis: There is no significant (less than 20 percent) increase in turbidity in Class II waters from the inflow of Class III waters adjacent to high lead cable-yarded clearcut harvest units through the application of the aquatic strategy Class III EEZ prescriptions.
>
> Hypothesis: There is no significant decrease in residual pool volume in Class I and Class II waters tributary reaches with gradients less than three percent after clearcutting and high lead cable yarding through the effectiveness of riparian management zone widths in holding in check materials transported from shallow-seated landslides.
>
> Hypothesis: There is no significant reduction of overstory tree canopy in Class II RMZs from wind throw after commercial thinning because of pre- and post-harvest tree stocking or RMZ widths, or both, reducing wind-related "depth-of-edge" effects.
>
> Hypothesis: There is no significant increase in summer (mid-July to mid-September), late afternoon average maximum temperatures measured in pools in Class I waters because low water temperatures are maintained in contributing Class II waters.

These examples of hypotheses to be tested through instream effectiveness monitoring illustrate how carefully questions need to be developed before designing and implementing instream effectiveness monitoring. They point to the need to establish criteria for determining what is "significant" (e.g., "less than 20 percent"), to clearly describe what exactly is to be monitored (e.g., turbidity vs. suspended sediment) and to specify where and when monitoring will occur (e.g., in Class III tributaries with gradients greater than three percent contributing to Class II waters and "mid-July to mid-September, late afternoon"). The hypotheses are stated in mechanistic terms to help ensure that the monitoring is directed toward investigating the linkages between prescriptions applied to

the hillslope and instream conditions. They also suggest how testing one hypothesis through monitoring might lead to another, through an accumulative method of inductive inference. By employing such a process of "strong inference" (Platt 1964), PALCO and the agencies will clarify which prescriptions of the aquatic strategy are inadequately holding in check impact mechanisms triggered by management activities.

PALCO will develop these types of hypotheses and the instream effectiveness monitoring strategies with the participation of the watershed analysis team members and agencies. Where the watershed analysis process has not been initiated, the PALCO and the agencies will develop sets of hypotheses to be tested through instream effectiveness monitoring that are informed by the experiences gained elsewhere in the region, where watershed analysis has been completed. In both circumstances, the actual hypotheses to be tested will be determined by the salient circumstances, management regimes and prescriptions specific to each hydrologic unit. Finally, PALCO and the agencies will establish a peer review panel to bring in interdisciplinary expertise to critique monitoring proposals on an annual basis, if necessary.

Application of Instream Effectiveness Monitoring Findings

PALCO and the agencies will use the results from the annual reviews of instream effectiveness monitoring to modify prescriptions that are identified as ineffective in protecting and restoring aquatic resources through the adaptive management process. At the same time, insights gained from this monitoring will confirm what prescriptions are working well. The changes in prescriptions will be designed to fit specific circumstances and impact mechanisms. For example, instream effectiveness monitoring might find that unacceptable increases in turbidity in Class III waters occur on certain soils after the adjacent stands on slopes greater than 50 percent have been clearcut, yarded by high lead cable and broadcast burned. This may lead to PALCO modifying, among others, the timing of timber operations, the regeneration and yarding methods and the level of vegetation retained within EEZs under these circumstances. In contrast, if under otherwise similar circumstances, instream effectiveness monitoring suggests that little or no increases in turbidity are found when the adjacent hillslopes are subject to intermediate treatments (e.g., commercial thinning), then, until there is evidence to the contrary, the management regime and prescriptions would be retained. The monitoring activity should continue long enough, however, to ensure that the prescriptions are tested under a wide range of conditions, including large but infrequent storm events.

3) Trend Monitoring

According to MacDonald and others (1991), trend monitoring implies a process where measurements are made at regular, well-spaced time intervals so as to determine a long-term trend in a particular parameter. This type of monitoring typically is not intended to evaluate specific management practices (as is the case with effectiveness monitoring). The results of trend monitoring, however, can corroborate the findings of effectiveness monitoring. Conversely, they can detect changes at different time and spatial scales from which effectiveness monitoring detects

changes. Trend monitoring can also serve to indicate whether watersheds as a whole are on a long-term trajectory of recovery from both natural and management-related perturbations.

Adoption of the Current Trend Monitoring Program to the PALCO Aquatic Conservation Plan. PALCO already has a significant trend monitoring program in place on its lands. The company has installed 52 permanent sampling stations. At each station aquatic macroinvertebrates, fine sediments, substrate size and crown cover are measured. In addition, stream bed surveys and measurements of continuous temperature and large woody debris are conducted at a subset of the 52 stations. Details of the data collection/analysis efforts associated with this program are as follows:

- Aquatic macroinvertebrates are collected using methods in the California Stream Bioassessment Procedures prepared by Jim Harrington of CDF&G. This methodology involves sampling riffle habitats using a kick net. Collected invertebrates are preserved in the field. In the laboratory, the samples are subsampled, and the first 300 invertebrates identified to family, and, where possible, to genus. The samples are being identified by Lauck, Lee and Lauck Inc. Their results are used to calculate abundance (if less than 300), species richness (i.e., number of taxa), and the Simpson and Hilsenhoff diversity indices.

- Bulk sediment samples are being used to assess the percent of fine sediments(<0.85mm, and < 4.7mm) as an indicator of suitability for salmon spawning. PALCO is using the shovel sample technique as described in "Field Comparison of Three Devices Used to Sample Substrate in Small Streams" by Grost and Hubert, 1991. Collected samples are processed by CDFG under contract to the company.

- Pebble counts are being used to calculate the median and 84th percentile sediment size (e.g., D50 and D84). These sediment measures can be tracked over time to determine whether sediments in a watercourse are generally becoming coarser or finer, which relates to both sediment loading rates, and cumulative effects from management activities. Pebble counts are being collected using the method described in "Stream Reference Sites" by Harrelson et al. (1994).

- Measurements of water temperature over the summer are taken with continuous recording thermometers (Hobos or Stowaways). In addition, “point” measurements of temperature are taken during most other monitoring activities. Temperature data are used to calculate the maximum weekly average temperature (MWAT).

- Canopy cover (percent) is being used to identify areas that may be subject to higher thermal loading (e.g., from sunlight), and to document regrowth of riparian areas harvested in the past. Measurements are taken using a spherical densimeter using methods in Flosi and Reynolds (1996).

- Stream bed surveys are being conducted to determine how stream bed elevation is changing over time. This, in turn, is related to both sediment and LWD loading to waters. The methods for these surveys were developed by Dr. Bill Trush (Humboldt State Univ.) in cooperation with Simpson Timber Company. The method involves measuring the elevation of the channel thalweg using an engineers level and permanent benchmarks that can be used to compare results among survey periods. PALCO has also begun measuring channel cross sections using permanent benchmarks to track changes in channel width/shape over time.

- As part of the stream bed surveys, PALCO is measuring the abundance (i.e., percentage of channel length composed of pools), size and depth of pools within each study reach.

- Large woody debris is being measured because of its value in creating fish habitat, and to assess how much LWD recruits from riparian buffers along the stream. The diameter, length and location of all LWD pieces in the thalweg mapping segments is being recorded yearly.

Although not currently a part of PALCO's trends monitoring program, PALCO intends to collect data on fish abundance, turbidity, and discharge in the future. For fish, PALCO will establish a number of survey reaches across the ownership. Where possible these reaches will be selected to correspond to locations already being measured for the trends monitoring variables noted above. These survey reaches will be assessed twice yearly, during the summer (July-August), and again during the spawning season (for which the timing will vary from year to year). Summer surveys will be conducted using electrofishing, underwater observation, seining, angling, or other methods as appropriate, although preference will be given to quantitative methods if they are feasible. Spawner surveys will primarily be conducted using visual observation techniques, although trapping, seining or angling may be used to collect individual fish for measurement, identification, or radio tagging.

Turbidity measurements were recommended in a review of PALCO's monitoring program prepared for EPA by Randy Klein (Klein 1997). Although expensive compared to other sampling efforts used in PALCO' monitoring program, Klein's review suggested that turbidity could be an effective way to determine whether fine sediment inputs to waters are increasing or decreasing over time. The company proposes to establish "pilot" turbidity monitoring stations. Results from this pilot program will be used to determine how and where to expand this program.

Historically, the USGS measured stream discharge at a series of stations on or adjacent to PALCO's land (e.g., Freshwater Creek, Larabee Creek). PALCO provided financial support for re-establishment of a gaging station on the Elk River, and intends to continue operation of this gage. The company is also considering establishment of gaging stations on Freshwater Creek, Yager Creek, and possibly in one or more of the smaller watersheds draining into the Eel River (e.g., Bear Creek). This monitoring effort would also be relatively expensive. PALCO and the agencies' decision on where to undertake this program will be made in the future based on the results of the Elk River "pilot" and watershed analyses conducted there and in other hydrologic units.

PALCO recognizes that new data or scientific studies and the findings of watershed analysis will result in future identification of other variables that would be valuable to monitor. Therefore, at their discretion, PALCO and the agencies will add to the list of monitoring variables outlined here at a later date.

Klein (1997) discussed the distribution of monitoring sites on PALCO's lands, and suggested installation of additional monitoring sites. PALCO agrees that some portions of its lands, for example, the Elk River drainage, have relatively few monitoring sites relative to their land area. In part, this is a result of statistical chance, as many sites were chosen using randomization techniques. However, it is also true that the company made the decision to intensively survey the Freshwater and Lawrence creek basins to more accurately assess the potential impacts of its forest practices. PALCO intends to continue this intensive approach to sampling in these basins, especially given concerns over the potential for cumulative effects. However, the company also anticipates adding new monitoring sites to fill any "holes" in its coverage. Selection of specific sites will be included as part of the watershed analysis process the company will be conducting on its lands.

PALCO and the agencies will review the current fifty-two monitoring locations and activities. They will confirm that the original intent underlying the selection of locations and instream parameters to be measured is consistent with the monitoring needs of the Aquatic Conservation Plan and follow the guidelines for monitoring found in the HCP Handbook (1996). This review will address and respond to comments from the public and local watershed specialist regarding PALCO's current trend monitoring effort. The PALCO and the agencies will provide important details regarding monitoring objectives and hypotheses, sampling and measurement methodologies, monitoring locations and distribution, frequency of sampling and statistical analyses. These cannot be finalized and disclosed at this time but must await the findings of watershed analysis, further quantitative and qualitative resource assessment and analysis (i.e., for the interim, for those hydrologic units where watershed analysis is not yet completed), or both. As stated in the HCP Handbook (1996), trend monitoring measures will be "¼as specific as possible and be commensurate with the project's scope and the severity of its effects." Further, PALCO and the agencies will develop target milestones for the life of the HCP for key instream parameters. These will necessarily be specific to each hydrologic unit, as their development must be informed and conditioned by prevailing physical conditions specific to each hydrologic unit.

As a further assurance that PALCO's trend monitoring program will follow the guidelines of the HCP Handbook (1996) and show clear trend information on the condition of waters in watersheds effected by implementation of the Aquatic Conservation Plan, PALCO and the agencies will establish a peer review panel comprised of scientists, resource professionals and the public living in and near the hydrologic units to be monitored. The panel will review the initial trend monitoring strategies developed by the PALCO and the agencies and provide recommendations for improvements. The peer review panel will validate that appropriate questions are being asked and that the proposed monitoring strategies are practicable and will give answers and management directions. The ultimate form of the trend monitoring will be approved by the reviewing agencies through the watershed analysis process.

Application of Trend Monitoring Findings

As stated above, trend monitoring alone is not an appropriate tool to evaluate the responses of watersheds and waters to specific management practices. This form of monitoring, however can be used to assess whether hillslope and instream attributes and functions are leading toward or away from properly functioning conditions and recovery. With the oversight of the agencies through annual reviews and the THP review process, PALCO will use the results of trend monitoring as part of their cumulative effects analyses in watershed analysis. PALCO will in turn, where appropriate, affect watershed-specific modifications in management regimes to reverse trends that lead way from properly functioning aquatic habitat conditions, or modify management restrictions to be more flexible for PALCO, when appropriate, through the watershed analysis prescription process or adaptive management.

f. Adaptive Management

Adaptive management will be used to change elements of the aquatic conservation plan in response to determination of effectiveness of current elements of the conservation plan for protecting and restoring stream conditions and fish populations. Thus, the effectiveness of the conservation plan is assessed by examining conditions on PALCO's ownership and determining if management is maintaining or achieve over time properly functioning aquatic habitat condition

Changes in elements of the conservation plan are warranted if watershed analysis, monitoring, any of the scientific studies or new information from outside the Plan show that properly functioning aquatic conditions are not being maintained, the Plan is not substantially moving the aquatic habitat towards achieving properly functioning conditions, that a more cost effective technique exists to attain the same biological or physical outcome, or if the information shows that PALCO can gain flexibility in the prescriptions and still attain properly functioning conditions. Adaptive management is the means to ensure that the conservation plan maintains or achieves, or time, the habitat goal of a properly functioning aquatic condition.

PALCO may propose changes to elements of the conservation plan as part of adaptive management. The wildlife agency shall approve any changes to the conservation plan. The Wildlife Agencies may also propose changes, for PALCOs consideration, based on the watershed analysis, monitoring, scientific studies or new information in order to maintain or achieve, over time, properly functioning aquatic habitat conditions.

4. BALD EAGLE CONSERVATION PLAN

a. Management Objectives

1. Implement nest site identification and protection measures which have a high probability of providing for successful nesting of bald eagles.

2. Minimize disturbance of foraging bald eagles.

b. Conservation Measures

1) Surveys

a. Focused surveys for bald eagle nests shall be conducted for THPs located within 0.5 miles of Class I waters that provide potential foraging habitat. Potential nesting habitat (old growth or residual forest with trees > 40" diameter) within THP areas and out to 0.5 miles from their boundaries shall be surveyed during the breeding season immediately prior to the commencement of operations. Operations shall not commence until surveys have been completed.

b. To increase the probability of detecting any adult eagles nesting on the ownership, surveys for eagles and their nests shall be conducted between March 1and April 15. Surveys shall consist of at least three site visits, one of which shall occur after April 1. Thorough searches for eagles and their nests shall be made of the survey area. Repeated float trips down Class I waters that provide potential foraging habitat or surveys conducted by airplane or helicopter to search for adult birds and nests may be necessary.

c. If bald eagles are observed during surveys, additional visits shall be conducted to determine if eagles are nesting within a THP area or within 0.5 miles of its boundary. This determination may be aided by observing the eagle's behavior, location, and direction of flight. Plan operations shall not commence until surveys have been completed and the results of any positive surveys have been reviewed and approved by the USFWS and CDFG.

d. Field personnel shall be trained to recognize bald eagle nests and other signs indicating their presence. Although most bald eagle nests are likely to occur within 0.5 miles of suitable foraging habitat, they could potentially occur anywhere on the Plan area where nesting habitat is suitable. Therefore, all THPs shall be evaluated for the existence of suitable nesting habitat and localized searches for nests and eagles shall be conducted if necessary.

e. Documentation (i.e., survey forms and written summary) of field surveys performed for THPs shall be provided to USFWS and CDFG annually.

2) Nest Site Protection Measures

a. Active nest trees shall be defined as a tree used by bald eagles for nesting at least once within the previous five years. If inadequate data exists to document the status of individual nests, they shall be considered to be active. Occupied nests shall be defined as nests currently being used by bald eagles for reproduction. This shall include territorial behavior by one or more adults in the vicinity of a known nest, nest construction, egg laying, incubation, or rearing of young.

b. No trees within 500 feet of an active bald eagle nest shall be cut without prior consultation and concurrence from the USFWS and CDFG. Harvest within the 500' radius will be limited to prescriptions which will enhance long term eagle habitat; such as precommercial or commercial thinning, selection, or an alternate prescription.

c. Timber operations shall not occur closer than 0.5 miles from occupied nests during the breeding season (January 15 through August 15, or post fledging). Blasting or pile driving activities shall not occur within 1.0 miles of occupied nests. Disturbance buffers may be modified with consultation and concurrence by USFWS and CDFG based upon topographic and other site-specific and project specific circumstances. Disturbance buffers may also be lifted through monitoring and a determination that the site is not occupied, that nesting is not occurring, has failed or that the young have fledged.

3) Mitigation for Disturbance of Foraging Eagles

a. Skyline cables over Class I waters shall be marked to reduce the possibility of collisions when operating in or adjacent to known bald eagle foraging habitat.

b. Winter foraging by bald eagles on the PALCO ownership is currently known to occur between November and February but is uncommon. Implementation of the aquatic strategy, specifically measures to reduce disturbance in the channel migration zones and

Class I RMZs and restrictions on winter use, construction, reconstruction and storm proofing of roads are expected to effectively minimize the potential for disturbance.

c. Monitoring

Nest sites for which buffers are established shall be monitored during the breeding season each year the THP is in effect and for at least one breeding season following completion of the plan. Annual reports describing monitoring efforts shall be provided to the USFWS and CDFG. These reports shall disclose the dates of surveys, identity of surveyors, survey methods, and results (nest condition, occupancy rates, and nesting success).

At five-year intervals, PALCO, USFWS, and CDFG shall meet to review the results of monitoring activities, evaluate implementation and effectiveness of measures, and evaluate potential procedural improvements.

5. PEREGRINE FALCON CONSERVATION PLAN

a. Management Objectives

Implement nest site identification and protection measures which have a high probability of providing for successful nesting of peregrine falcons.

b. Conservation Measures

1) Surveys

Surveys of potential nesting habitat (i.e., at Scotia Bluffs, Holmes Bluff or any other location where suitable cliffs over 70' in height occur) shall be conducted within THP areas and within 0.5 mile of their boundaries if operations will occur during the breeding season (January 15-August 15). This distance shall be increased to 1 mile for projects involving blasting or pile driving activities. Surveys shall follow the guidelines in Pagel (1992), Protocol for Observing Known and Potential Peregrine Falcon Eyries in the Pacific Northwest, any year operations will occur.

- Field personnel shall be trained to recognize peregrines and potential nesting habitat.

- Documentation (i.e. survey forms and written summary) of field surveys performed for THPs shall be provided to USFWS and CDFG annually.

2) Nest Site Protection Measures

- No trees within 500 feet of an active peregrine falcon nest shall be cut without prior consultation and concurrence from the USFWS and CDFG.

- To minimize disturbance, timber operations shall not occur closer than 0.5 miles from occupied nests during the breeding season. Blasting, pile driving, helicopter yarding or similar activities (other than ambient conditions) capable of introducing loud noise, shall not occur within 1.0 mile of occupied nests.

Disturbance buffers may be modified with consultation and concurrence by USFWS and CDFG based upon topographic and other site-specific and project specific circumstances. Disturbance buffers may also be lifted through monitoring and a determination that the site is not occupied, that nesting is not occurring, has failed or that the young have fledged. Surveys shall follow the guidelines in Pagel 1992), Protocol for Observing Known and Potential Peregrine Falcon Eyries in the Pacific Northwest.

c. Monitoring

Nest sites for which buffers are established shall be monitored during the breeding season each year the THP is in effect and for at least one breeding season following completion of the plan. Annual reports describing monitoring efforts shall be provided to the USFWS and CDFG. These reports shall disclose the dates of surveys, identity of surveyors, survey methods, and results (nest condition, occupancy rates, and nesting success).

At five-year intervals, PALCO, USFWS, and CDFG shall meet to review the results of monitoring activities, evaluate implementation and effectiveness of measures, and evaluate potential procedural improvements.

6. SNOWY PLOVER CONSERVATION PLAN

a. Conservation Measures

PALCO will conduct reconnaisance-level surveys (as described in USACE gravel extraction permits for the area) on gravel bars above the Rio Dell bridge. If reconnaisance level surveys locate plovers above the Rio Dell bridge, full protocol surveys will be instituted on all gravel bars within one mile of the sighting If snowy plovers are detected, the individual(s) shall be observed for evidence of nesting behavior. If a nest site is discovered, a 1,000' seasonal operations buffer will be applied until the end of the breeding season, or until it is determined that the nest has failed, or nesting has been completed.

If PALCO acquires rights to gravel bars on the Eel River downstream from the Rio Dell bridge, those bars shall be surveyed in full compliance with USFWS protocol existing at the time, and nest protection measures implemented that are consistent with measures used in the Eel River area at the time. If the species' breeding range is determined by any means to extend up the Eel River to the Rio Dell bridge, PALCO shall begin full protocol surveys of gravel bars above the Rio Dell bridge, and if nests are located, implement nest protection measures as above. PALCO shall evaluate proposed gravel extraction levels with respect to potential indirect effects downstream. Within three years of permit issuance, PALCO and the agencies will meet to evaluate indirect effects of extraction on downstream gravel bars and to determine whether practicable mitigation measures would be appropriate**.**

7. BANK SWALLOW CONSERVATION PLAN

a. Management Objectives

- Avoid impacts to bank swallow nesting colonies on streambanks and hillsides.
- Prevent nest colony establishment in stock-piled sand associated with in-stream mining operations

b. Conservation Measures

Aquatic conservation measures, principally the channel migration zone and riparian management zone measures will minimize potential disturbance to nesting colonies.

Where new road construction crossing low gradient Class I waters is planned, and potential bank swallow habitat exists, PALCO shall survey the proposed alignment once in May and once in June to identify any nest colonies within 200' of the construction area. If nest colonies are found, PALCO shall consult with USFWS and CDFG to jointly develop measures which shall maintain the nest colony.

- Activities which may indirectly impact or disturb active nest colonies shall be separated by at least a 200' buffer during May and June. Alternative mitigation measures may be developed through consultation with USFWS and CDFG.
- PALCO shall attempt to prevent bank swallows from nesting in stock-piled sand associated with in-stream mining operations using netting or other means developed in consultation with USFWS and DFG.

c. Monitoring

When conservation measures 2b or 2c are implemented, PALCO shall monitor the nest colony each year that the covered activity operates within 300' of the site and for one year following cessation of operations. Monitoring shall determine the approximate dates that the colony is established and abandoned, and the approximate number of adult birds and document any indication that disturbance adversely affects success of the colony. Documentation (i.e. survey forms and written summary) of field surveys shall be provided to USFWS and CDFG annually. Locations of identified colonies shall be reported by PALCO, within 90 days of discovery, to the DFG Natural Diversity Data Base.

At five-year intervals, PALCO, USFWS, and CDFG shall meet to review the results of monitoring activities, evaluate implementation and effectiveness of measures, and evaluate potential procedural improvements.

8. PACIFIC FISHER CONSERVATION PLAN

The conservation strategy for this species is a combination of a "habitat based" approach with an additional structural component element. Specifically, the silvicultural requirements associated with RMZs, mass wasting avoidance strategy, cumulative effects/disturbance index restrictions, marbled murrelet conservation areas, and the retention standard of 10% late seral habitat for each WAA , is likely to provide for denning and resting habitat for Pacific fishers

a. Management Objectives

Maintain a sufficient amount of suitable habitat to contribute to a sustainable population of Pacific fisher in the Coastal Province of Northern California.

b. Conservation Measures

Retention of late seral habitat on the ownership, through the life of the permit, is expected to provide sufficient habitat, in terms of quantity, quality and distribution to contribute to a viable population. CMZs and RMZs are expected to provide connectivity across the landscape. In many locations, CMZs and RMZs will intersect with other RMZ's or be augmented by habitat subject to silvicultural restrictions (e.g., northern spotted owl activity sites, mass wasting sites or steep slopes adjacent to RMZs). These areas, MMCA's and adjoining public lands will form an interconnecting network of habitat which is expected to provide opportunities for denning and resting sites in the Humboldt, Yager, and Van Duzen WAAs. PALCO land within the Bear Mattole and Eel WAAs are not expected to provide blocks of late seral habitat through the life of the permit. Late seral and old growth habitat on public lands adjacent to PALCO ownership in these two WAAs are expected to provide suitable habitat for the species.

The conservation measures to retain and recruit habitat structural components within and outside of RMZs across the ownership are expected to provide older forest legacies in younger stands when these stands reach a mid- successional seral stage. These legacy components are expected to provide suitable substrate for Pacific fisher denning and resting sites.

c. Implementation/Compliance Monitoring

Seral stage distribution will be tracked and reported as described in the conservation measures described in this Appendix under Measures to Conserve Habitat Diversity and Structural Components.

d. Effectiveness Monitoring

Within 1 year of permit issuance PALCO, USFWS, and CDFG will jointly develop a forest carnivore survey methodology. The objective would be to determine the extent of Pacific fisher use of habitat types and seral stages present on PALCO lands.

The research/monitoring project will commence by the end of the second year after permit issuance. Between years 5 and 7 of the permit, PALCO, USFWS ,and CDFG shall meet to review the results of surveys and potential additional research needs.

9. RED TREE VOLE CONSERVATION PLAN

This conservation strategy for this species has a "habitat based" approach. Specifically, the silvicultural requirements associated with RMZs, mass wasting avoidance strategy, cumulative effects/disturbance index restrictions, marbled murrelet conservation areas, and the retention

standard of 10% late seral habitat for each watershed assessment area is likely to provide habitat for red tree voles.

There is little published literature available on habitat use and population status or trend of red tree voles in California. Anecdotal information from several sources in Northern California (CDFG, 1997) suggests a broader habitat usage than previously documented for red tree voles in Oregon. Additional information on habitat use is needed on this species.

a. Management Objective

Sustain viable red tree vole populations within each watershed assessment area on the PALCO ownership, through the life of the permit.

b. Conservation Measure

Late seral habitat retention on the ownership, through the life of the permit, is expected to provide sufficient habitat, in terms of quantity, quality and distribution to support a viable population. CMZs and RMZs are expected to provide connectivity across the landscape. In many locations, CMZs and RMZs will intersect with other RMZs or be augmented by habitat subject to silvicultural restrictions (e.g., northern spotted owl activity sites, mass wasting sites or steep slopes adjacent to RMZs). These areas, MMCA's and adjoining public lands will form an interconnecting network of habitat which is expected to maintain the species in the Humboldt, Yager, and Van Duzen WAAs. PALCO land within the Bear Mattole and Eel WAAs are not expected to provide blocks of late seral habitat through the life of the permit. Late seral and old growth habitat on public lands adjacent to PALCO ownership in these WAAs are expected to provide suitable habitat for the species.

c. Implementation/Compliance Monitoring

Seral stage distribution will be tracked and reported as described in the conservation measures described in this Appendix under Measures to Conserve Habitat Diversity and Structural Components.

d. Effectiveness Monitoring and Adaptive Management

Within 1 year of permit issuance PALCO, USFWS, and CDFG will jointly develop a research/monitoring effort to examine red tree vole habitat seral stage use and habitat connectivity requirements on PALCO lands. The objective would be to determine conditions needed in younger forests to provide for and promote opportunities for maintaining tree vole populations capable of interbreeding and dispersing to other suitable habitats. Survey methodology will be based on the draft study plan developed by the Pacific Northwest Research Station (Biswell, 1997).

The research/monitoring project will commence by the end of the second year after permit issuance. Between years 5 and 7 of the permit, PALCO, USFWS ,and CDFG shall meet to review the results of monitoring/research activities and any other new information available on the species. Total acreage of habitat considered to be capable of supporting red tree vole populations will include an assessment of habitat connectivity based on available information on the dispersal capabilities of the species. This information will be used to evaluate the effectiveness of conservation measures and evaluate potential changes to the measures. In the event that PALCO, USFWS, and CDFG cannot reach consensus on changes necessary to the operating conservation plan, the USFWS and CDFG may terminate coverage for the California red tree vole under the incidental take permit.

10. AMPHIBIAN AND REPTILE CONSERVATION PLAN

a. Management Objectives

Sustain viable populations of the Northern red-legged frog, foothill yellow-legged frog, tailed frog, Southern torrent salamander, and the Western pond turtle within each watershed assessment area in which they occur on the PALCO ownership, through the life of the permit.

b. Conservation Measures

Conservation measures outlined in the Aquatic Conservation Plan are expected to provide for sustainable populations of these species where suitable habitat types occur across PALCOs ownership. This plan outlines interim habitat protection measures for aquatic and adjacent riparian habitats as well as upslope management practices that are designed to reduce impacts to aquatic resources.

As part of the watershed analysis process an amphibian and reptile assessment module shall be developed which includes key and critical questions regarding life history requirements, including those upslope of the RMZ boundaries. This module will be part of every watershed analysis conducted under the Plan. Results from this module shall be integrated into synthesis and prescription development to minimize and mitigate management effects on all phases of life history. Refer to the Aquatic Conservation Plan for additional information.

c. Monitoring

Refer to the Aquatic Conservation Plan for a description of the Implementation/compliance and effectiveness monitoring.

11. MEASURES TO CONSERVE HABITAT DIVERSITY AND STRUCTURAL COMPONENTS

a. Management Objective

1) Habitat Diversity

Ensure a mix of vegetation types and seral stages are maintained across the landscape over the permit period.

2) Structural Components

Maintain and recruit sufficient amounts and distribution of forest structural components to contribute to the maintenance of wildlife species covered under incidental take permit.

b. Conservation Measures

1) Habitat Diversity

At the end of each five year period, PALCO will report the seral stage distribution for each hydrologic unit to gauge conformity with projected forest seral types for the plan area described in the final Sustained Yield Plan as approved by CDF and demonstrate compliance with the following measure in the HCP:

Throughout the planning period, PALCO's forested lands within each WAA will include at least 10% late seral, 5% mid-successional, 5% young forest, and 5% forest opening.

2) Habitat Structural Components

- All snags (standing dead trees) that do not constitute a safety hazard to workers will be retained during timber harvest.

- At a minimum, the following numbers of snags (conifer and hardwood) shall remain averaged over the Timber Harvesting Plan area following timber harvest and site preparation*:

  - 1.2 snags per acre over 30 inches dbh and over 30 feet tall
  - 2.4 snags per acre over 20 inches dbh and over 16 feet tall
  - 1.2 snags per acre over 15 inches dbh and over 12 feet tall

  (*Larger snags may be substituted for smaller snags.)

- Snags in RMZs adjacent to harvest units may be counted toward the objective; but at least half the snags in each size category must be outside Class I and II RMZs.

- If snags are not present to meet the above objective, green trees in the same size categories shall be retained in numbers sufficient to meet the objective. Conifer species other than redwood shall have priority for retention. Green trees identified as replacement trees for snags shall be retained during subsequent timber harvest entries through the permit term.

- In the event of an emergency, as described in Section 1052.1 of the CFPR, such as wildfire, pest or disease outbreak, the requirement for retention of all snags may be waved through consultation with and approval by the USFWS and the CDFG.

- Retain at least 4 live cull trees per acre outside of Class I and II RMZs that do not constitute a safety hazard. Trees 30 inches dbh, and trees with visible defects such as broken tops, deformities, or cavities will have priority for retention. Live cull trees may include trees with merchantable logs. These trees shall be retained during subsequent timber harvest entries through the permit term so long as they do not constitute a safety hazard..

- All live hardwood trees over 30 inches dbh that do not constitute a safety hazard will be retained following timber harvest and site preparation, to a maximum of 2 per acre. Hardwoods within all RMZs count towards this objective.

- Two logs per acre greater than 15 inches in diameter and over 20 feet long will remain following timber harvest and site preparation. One of these logs per acre must be in decay class 1, 2, or 3 (Maser and Trapp, 1984). Hollow logs over 30 inches in diameter will have priority for retention. Logs in Class I and II RMZs will not be counted toward this objective. There will be no requirement to leave down logs where they do not exist currently unless results of the first 5 years of monitoring indicate management objectives are unlikely to be met.

- Snag, live cull, hardwood, and down log conservation measures shall apply to Timber Harvest Plans , Timber Harvest Exemptions, and Notice of Emergency Timber Operations, and will be evaluated based on the average number measured over a 40 acre harvest unit.

c. Monitoring

1) Implementation/Compliance

Due to the current lack of information regarding quantity and quality of snags and downed logs, monitoring is a key component of this strategy. Monitoring will develop data on these habitat components for each hydro logic unit of the PALCO ownership.

- During preparation of Timber Harvesting Plans, the RPF (or designee) shall gather information on presence of snags, down logs, hardwoods, and live culls for inclusion in the habitat component monitoring process described below.

- Monitoring of snags, live culls, hardwoods, and downed logs will occur during reforestation inspections, timber stand improvement monitoring, or timber stand cruises. This monitoring program may be altered in the future, but if alternations are made they will conform to the standards set forth here, and those developed in consultation with USFWS and CDFG.

- A training program for Registered Professional Foresters, wildlife and fisheries biologists, Licensed Timber Operators, and all other technicians responsible for implementing this strategy will be designed and implemented. PALCO will work with USFWS and CDFG in developing the training program.

- At the end of the first year of plan implementation, PALCO will meet with the USFWS and CDFG to review the data collection and monitoring procedures and determine if they are effective in producing the information required to implement the snag and downed log measures. Changes in procedures, if necessary, will be developed by PALCO in cooperation with USFWS and CDFG.

2) Effectiveness Monitoring and Adaptive Management

- To ensure the HCP measures will be effective in achieving the desired level and distribution of snags and down logs, PALCO shall conduct the following:

- After five years of plan implementation, the effectiveness of the recruitment measures will be evaluated against the objectives based on monitoring results and following an intensive inventory and measuring of stand components. If the snag objectives are not being met through the recruitment procedures identified above, PALCO will develop and implement aggressive measures. Such measures may include additional marking and retention of recruitment trees, girdling and inoculation of trees with pathogens to accelerate mortality and decay, or modification of site preparation techniques.

- In addition to the snag and down log inventories conducted during reforestation inspections, timber stand improvement monitoring , and timber stand cruises, a random sampling methodology will be developed in consultation with the USFWS and the CDFG, and implemented on a 5-10 year basis throughout the life of the permit. This sampling design will follow the framework described in Volume 3, Part E of the July 1998 Draft HCP for timber volume estimates.

- There will be no requirement to leave down logs where they do not exist currently until results of the first 5 years of monitoring have been evaluated. If the down log objectives are not being met through the recruitment measures identified in the HCP above, PALCO will develop and implement additional measures in consultation with the USFWS and CDFG.

- The HCP Monitor, shall have full access to PALCO's land, at all times, to inspect any Covered Activity, and shall be present on site during every timber harvest conducted by or on behalf of PALCO. The HCP Monitor shall also, at the request of the wildlife agencies, monitor the effectiveness of the HCP measure for retaining and recruiting structural components of wildlife habitat.

12. CONSERVATION PLAN FOR SENSITIVE PLANTS

Several Measures Necessary to Avoid Significant Impacts to Plants

Presence of rare species will be determined through field surveys conducted during planning of covered activities including, but not limited to, development of THPs, planning for new road construction and development of quarries or borrow pits. The list of potentially occurring rare species (Table 3.9-4 of DEIR) will be updated each year by PALCO, using available information from CDFG, USFWS, NDDB and the CNPS inventory. Copies of this list shall be forwarded to CDFG, USFWS and CDF upon completion. For convenience, the term "rare" shall be used in

subsequent text to refer to species listed as endangered, threatened or rare, and additional species, not yet formally designated by any government but which meet the criteria for listing (i.e., CNPS lists 1A, 1B or 2).

The following procedures will be followed to provide a high probability that rare plants are discovered during the planning stage for covered activities and that mitigation necessary to avoid jeopardy and reduce impacts to a level which is not significant is accomplished.

1. Within 90 days of incidental take permit issuance, a qualified botanist retained by PALCO shall review the plants identified in the July 1998 Draft HCP in Volume 1, Table 3, List B Species and Table 3.9-4 of the DEIR. Based upon existing information, the botanist shall determine which habitat types/plant communities occurring within the covered lands may support these species.

2. Once the habitat types potentially supporting these species have been identified, a description or guide shall be prepared by the botanist and PALCO biologists to assist PALCO employees and contractors in identifying the presence of these habitat types when performing covered activities. These habitat guides may include text, photographs, lists of associated species, drawings, maps and other resources identified by the botanist. These guides shall be submitted to USFWS and CDFG for review and comment, and final approval.

3. Within 12 months of issuance of the incidental take permit, PALCO shall train registered professional foresters and other appropriate employees and contractors in the use of the habitat guides to recognize potential habitat for rare plant species.

4. When PALCO employees and/or contractors identify potential habitat that may be affected by a covered activity, PALCO shall retain a qualified botanist to verify the habitat determination and perform a survey, at the time of year appropriate to identify the subject species at an intensity sufficient to detect presence of the target species.

5. Results of these surveys shall be included with any THP submitted to the CDF for the subject project. The results shall also be submitted to USFWS and CDFG as part of PALCO's annual report, and, if requested by either of the agencies.

6. When rare plant species are detected to be present in habitat that may be affected by a covered activity, PALCO shall implement feasible measures to avoid, minimize, and/or mitigate significant adverse effects to such species. These measures may include, but are not limited to, buffers, adjusting the location of covered activities, employing alternative methods to conducting covered activities (e.g., re-routing roads, narrowing roads, tractor or helicopter yarding). PALCO shall consult with USFWS for Federally listed species and CDFG for all rare plant species. Such measures may be developed and proposed by PALCO, but they must be approved by USFWS, as appropriate, and CDFG. For THPs, USFWS, as appropriate, and CDFG shall recommend to CDF all feasible measures to avoid, minimize, and/or mitigate significant adverse effects and CDF shall require one or more of such measures sufficient to provide such protection.

7. Locations of identified populations of rare plant species shall be reported by PALCO, within 90 days of discovery, to the NDDB.

13. THP CHECK LIST AND HCP MONITOR

PALCO resource professionals preparing THPs and timber harvest exemptions and agencies conducting the environmental review of PALCO's plans will be guided by the "Pacific Lumber Company Timber Harvest Plan Checklist." The checklist will be used to confirm that all relevant elements of the Operating Conservation Program are contained in the THPs and made enforceable under the THPs. PALCO and the Wildlife Agencies will revise the checklist during watershed analysis to create a THP checklist for each watershed to ensure implementation of watershed-specific prescriptions.

To monitor compliance with and effectiveness of each of the Operating Conservation Programs above, PALCO shall fund a third party entity or entities to monitor the implementation of the HCP Operating Conservation Program. This entity or entities is selected and approved by the Wildlife Agencies to monitor on behalf of the Wildlife Agencies, and is known as the "HCP Monitor". The HCP Monitor shall also monitor the effectiveness of the Plan if directed by the Wildlife Agencies. The HCP monitor shall be qualified in forestry, fisheries biology and wildlife biology. The HCP Monitor shall have full access to PALCO's land, at all times, to inspect any Covered Activity, and shall be present on site during every timber harvest conducted by or on behalf of PALCO.

The HCP Monitor shall report immediately to designated representatives of the Wildlife Agencies and CDF any deviations by PALCO from the conservation and management measures provided for under the HCP Operating Conservation Program so that the Wildlife Agencies and CDF may take appropriate action to enforce the federal permit and state permit, the California Forest Practice Act and other applicable federal and state laws. The HCP Monitor shall also report quarterly to the Wildlife Agencies concerning implementation and compliance by PALCO.
The intensity of the compliance monitoring by the HCP Monitor will be reevaluated by the Wildlife Agencies at the end of the first ten year period following the effective date of the HCP, and every ten years thereafter based on PALCO's record of compliance during the prior ten year period.

G. IMPACTS OF THE HCP ON COVERED SPECIES

Impacts of the HCP on covered species are discussed in Chapter 3 of the EIS/EIR. Refer to Tables 9 through 12 and Figures 1 and 2 for a summary of effects on vegetation and RMZs.

H. FUNDING

PALCO has years of experience conducting wildlife surveys and biological monitoring for species under the state and federal Endangered Species Acts as well as to assure compliance with other statutory and regulatory regimes, particularly the California Forest Practices Act and the Rules of the California Board of Forestry. This compliance and effectiveness monitoring work has been done by various in-house biological and technical staff as well as by outside, independent contractors. PALCO has undertaken this monitoring and surveying under a wide variety of circumstances across its 200,000 acres of commercial timberland. In addition, PALCO has over one year of experience conducting storm-proofing of its roads and landings, with dedicated crew and equipment, as described in the HCP. These experiences have provided PALCO with the information and background necessary to evaluate and estimate the costs that will be associated with compliance and effectiveness monitoring and storm-proofing across the landscape.

PALCO has evaluated its labor, equipment, and related administrative and data management costs so as to realistically plan and budget for the compliance and effectiveness monitoring, and storm-proofing requirements integral to HCP. Briefly, the expenses are anticipated to be approximately $2 million annually. This estimate is based on the anticipated costs of compliance and effectiveness monitoring for all mitigation and minimization measures now included within the HCP and the out of pocket costs for road and landing storm-proofing.

Compliance monitoring is currently accomplished in a wide variety of ways, using primarily in-house staff associated with THP preparation, forestry fieldwork, road maintenance and improvement, timber re-inventorying, remote sensing and mapping, and similar land management efforts. Because this work is often done in connection with other planned and budgeted activities, it has been accomplished at only very modest, if any increased cost factors. However, for purposes of the final HCP, cost and planning estimate have been based upon work by an independent compliance monitor(s) and will entail compliance efforts not currently required, or not formally reported to wildlife agencies on a regular or periodic basis. Compliance monitoring costs are evaluated at rates generally paid to forestry technicians, consulting foresters and other technically trained and experienced consultants. Considering all these factors, it is reasonable to estimate that the compliance monitoring component of the HCP will cost approximately $250,000.00 per year.

Efforts such as tree retention verification, road maintenance checking, plot surveying and evaluation can be accomplished with a minimal staff. Annual or periodic reporting in accord with the final HCP will take additional time and represents a significant portion of the expense.

In some instances, an independent compliance monitor may be requested or required to perform monitoring or measures included in the HCP that are more appropriately considered “effectiveness” monitoring. Because these activities are at best yet uncertain, they are not definitively subject to evaluation and cost planning. Utilizing a conservative cost factor equivalent to that anticipated for independent compliance monitoring, the annual cost would be expected to be approximately $250,000.00 per year.

Road storm-proofing will comprise by far the most significant financial cost secured by the required undertaking. The additional conservation and mitigation measures included in the final HCP have increased the anticipated costs. Road storm-proofing may require out-of-pocked

expenditures as high as $20,000 per mile in rare cases where significant drainage and erosion control reconstruction or other engineered work must be undertaken, over and above road and landing surface treatments. This amount has been used to estimate maximum expenses for purposes of planning and budgeting. Because the final agency requirements in the final HCP provide for storm-proofing 75 miles or road per year, the worst-case maximum cost could approach $1.5 million per year.

In light of these considerations, a security of $2 million is adequate for securing the compliance monitoring, effectiveness monitoring, and road storm-proofing requirements in the HCPs Operating Conservation Program. PALCO shall post security to CDFG within 15 days of the Effective DateThe security may be a pledged savings or trust account, certificate of deposit, irrevocable letter of credit, or other form approved by the Wildlife Agencies. The security will be renewed automatically annually and replenished as necessary to the amount of $ 2 million until PALCO completes its obligations under the Federal Permit and State Permit. The security shall be adjusted annually for inflation.

PALCO has, and will expend, such funds as may be necessary to fulfill all of its conservation and management obligations under the ITPs as described in the HCP's Operating Conservation Program and the IA. The funding sources that PALCO will use to fulfill its Permit obligations will include income derived from PALCO's Covered Activities on the Covered Lands. By February 1 of each year the Federal and/or State Permit is in effect, PALCO shall submit, concurrently with its submission of the Annual Report, an annual budget with regard to its obligations under the HCP, approved by its Board of Directors, to the Wildlife Agencies, demonstrating that sufficient funds to carry out PALCO's commitments under the Federal Permit and State Permit for that fiscal year have been authorized for expenditure. PALCO will promptly notify the Wildlife Agencies of any material change in PALCO's funding resources. A material change in PALCO's funding resources is any change in the financial condition of PALCO which will adversely affect PALCO's ability to manage the Covered Lands in accordance with the terms of this Agreement and the HCP's Operating Conservation Program.

PALCO will provide the first annual budget covering the period immediately following permit issuance up to the end of the first calendar year of operation within 15 days of the Effective Date.

I. OTHER REQUIREMENTS

Another measure necessary for purposes of the Plan is approval of the Implementation Agreement between the Agencies and PALCO. The Implementation Agreement is included in the EIS/EIR as Appendix S.

Figure 1
Projected Forest Seral Types for the Plan Area by Decade

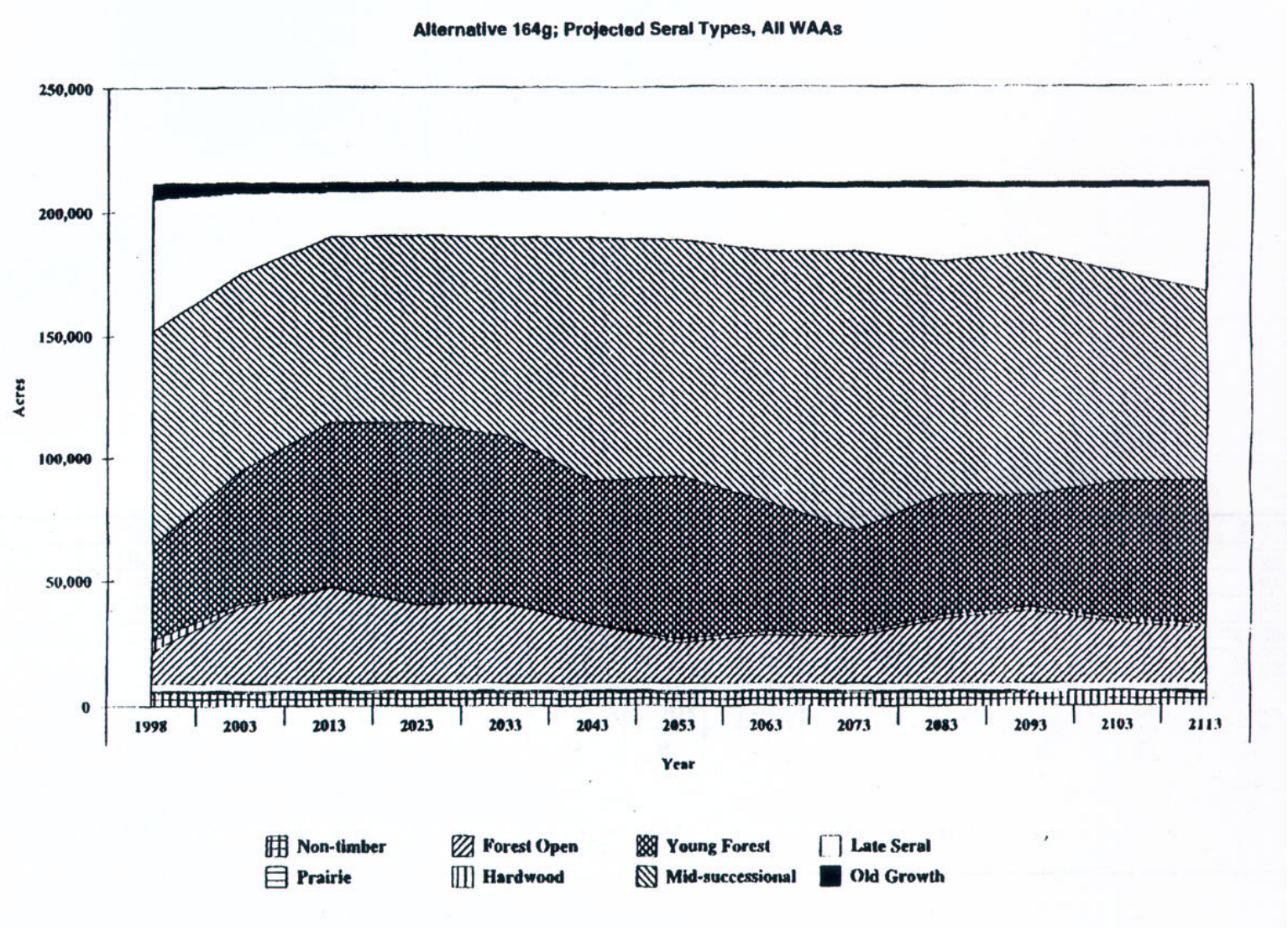
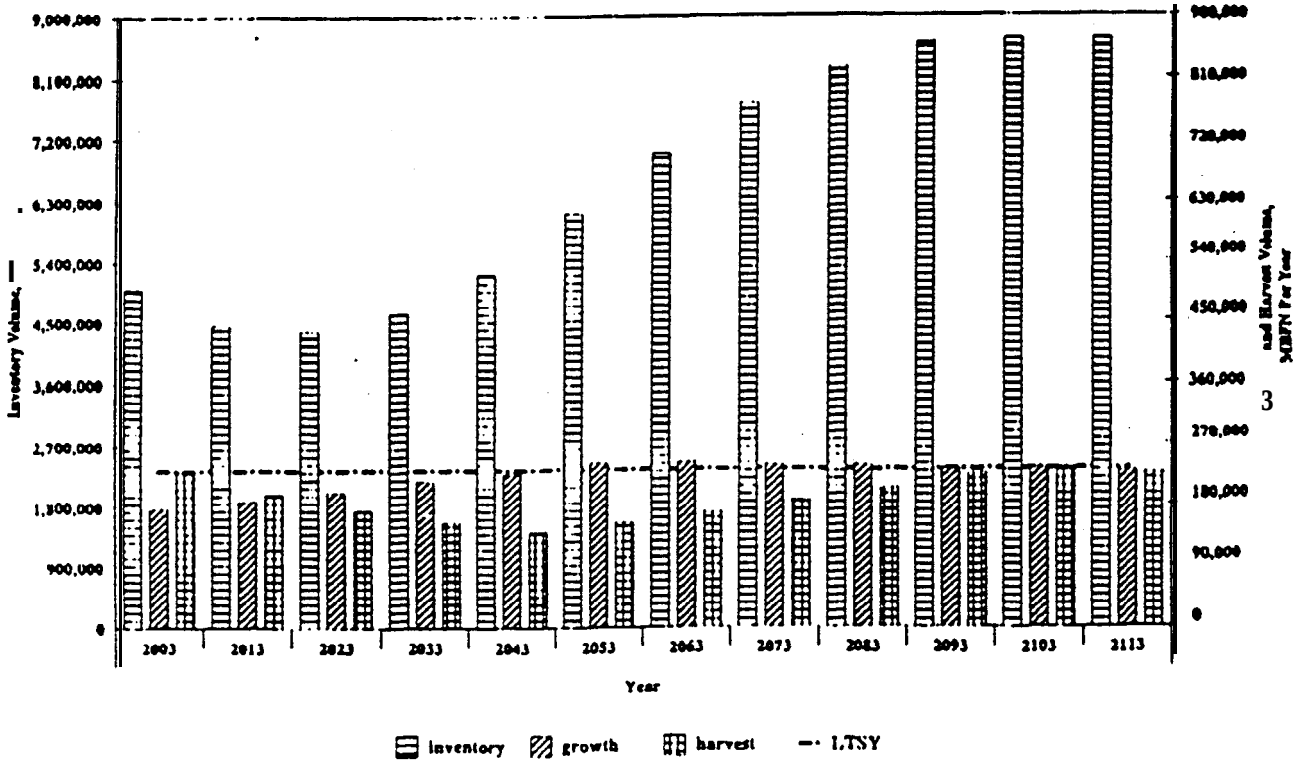
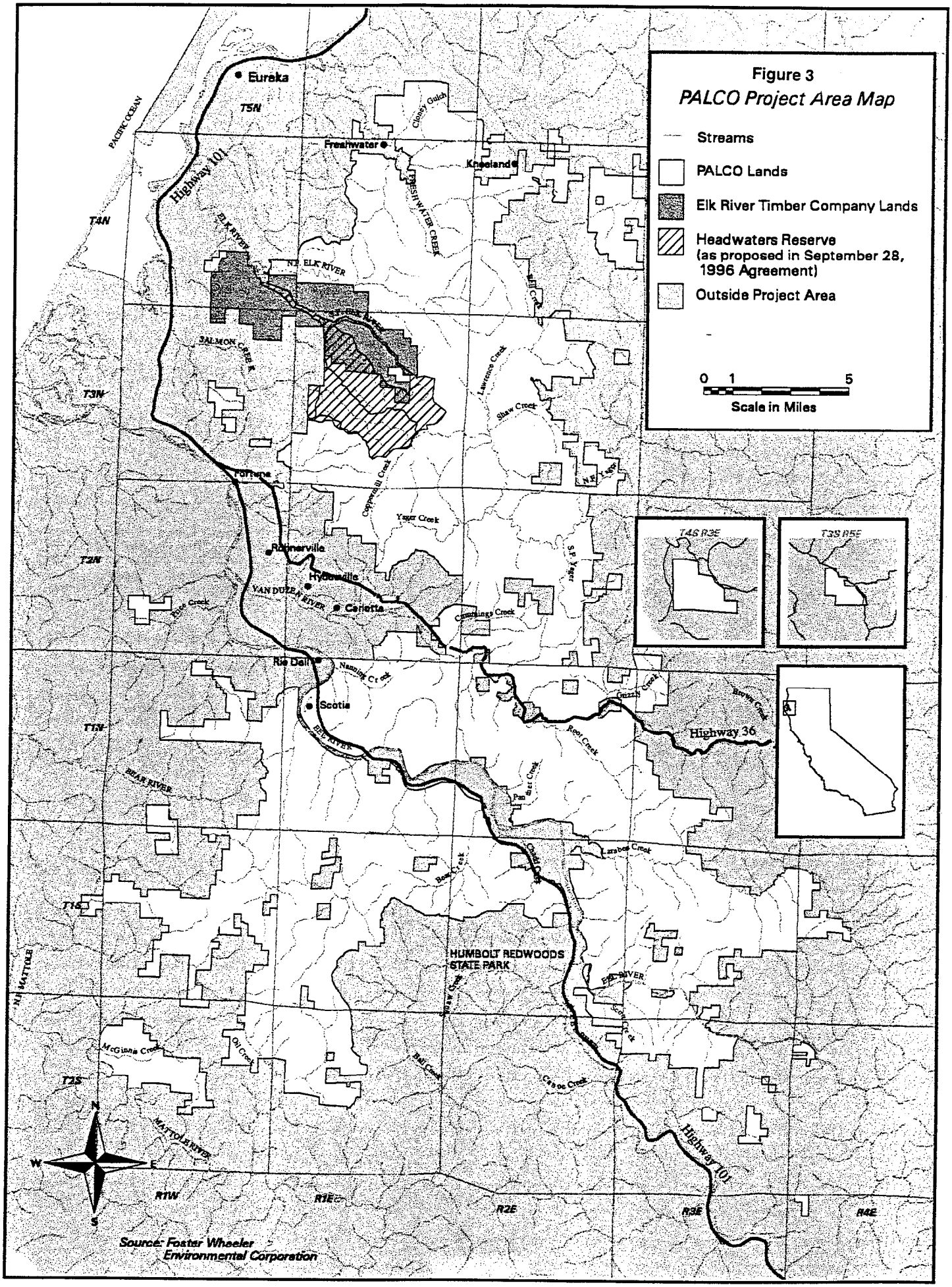


Figure 2

Inventory, Growth, and Harvest per Decade



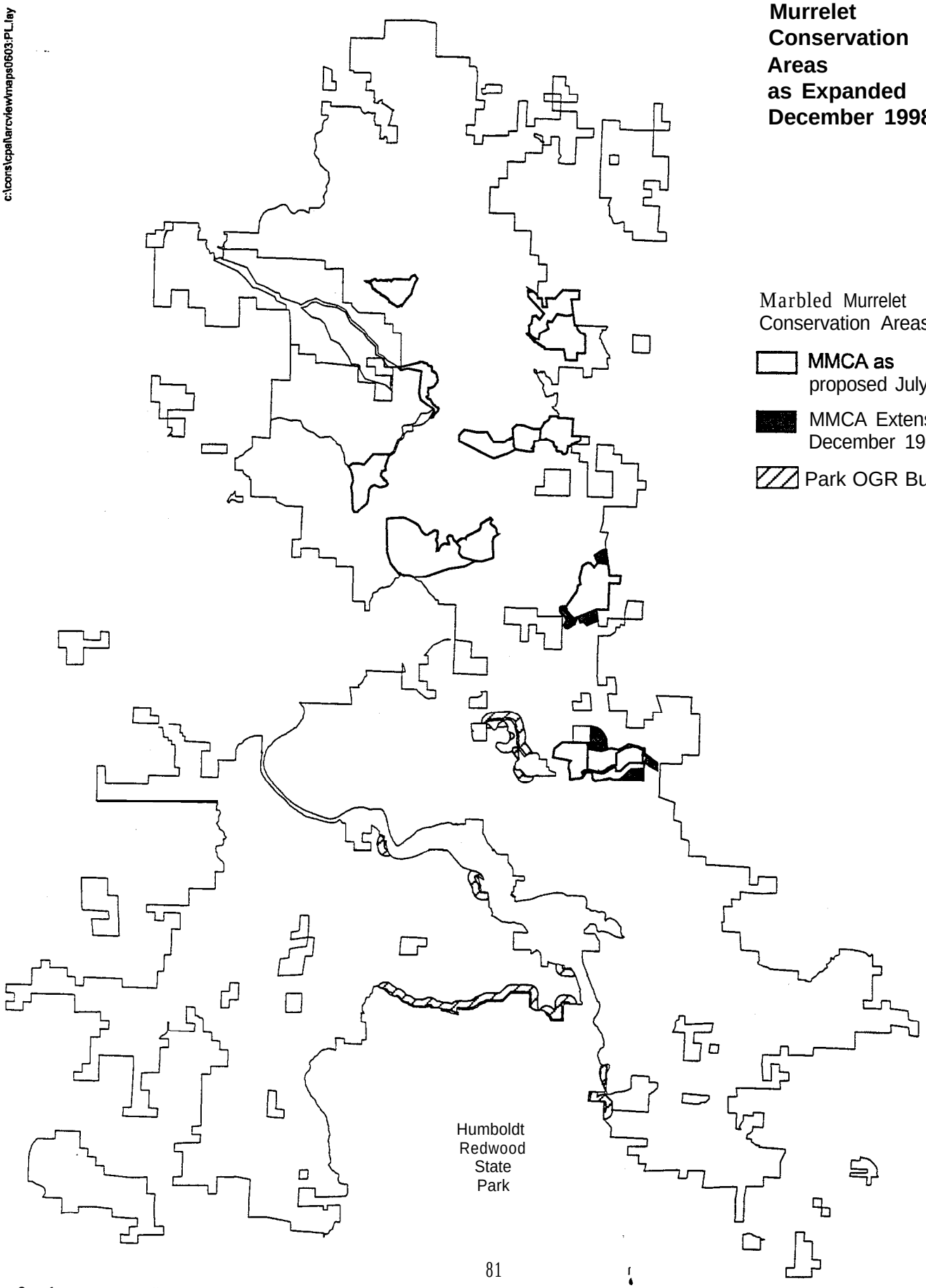


/blackcomb2/palco2/arnis/ps-vicinity.aml –September 21, 1998

Figure 4A

Pacific Lumber HCP Murrelet Conservation Areas as Expanded December 1998

c:\cons\cpal\arcview\maps0603\PL_lay



TRA 1/7/99

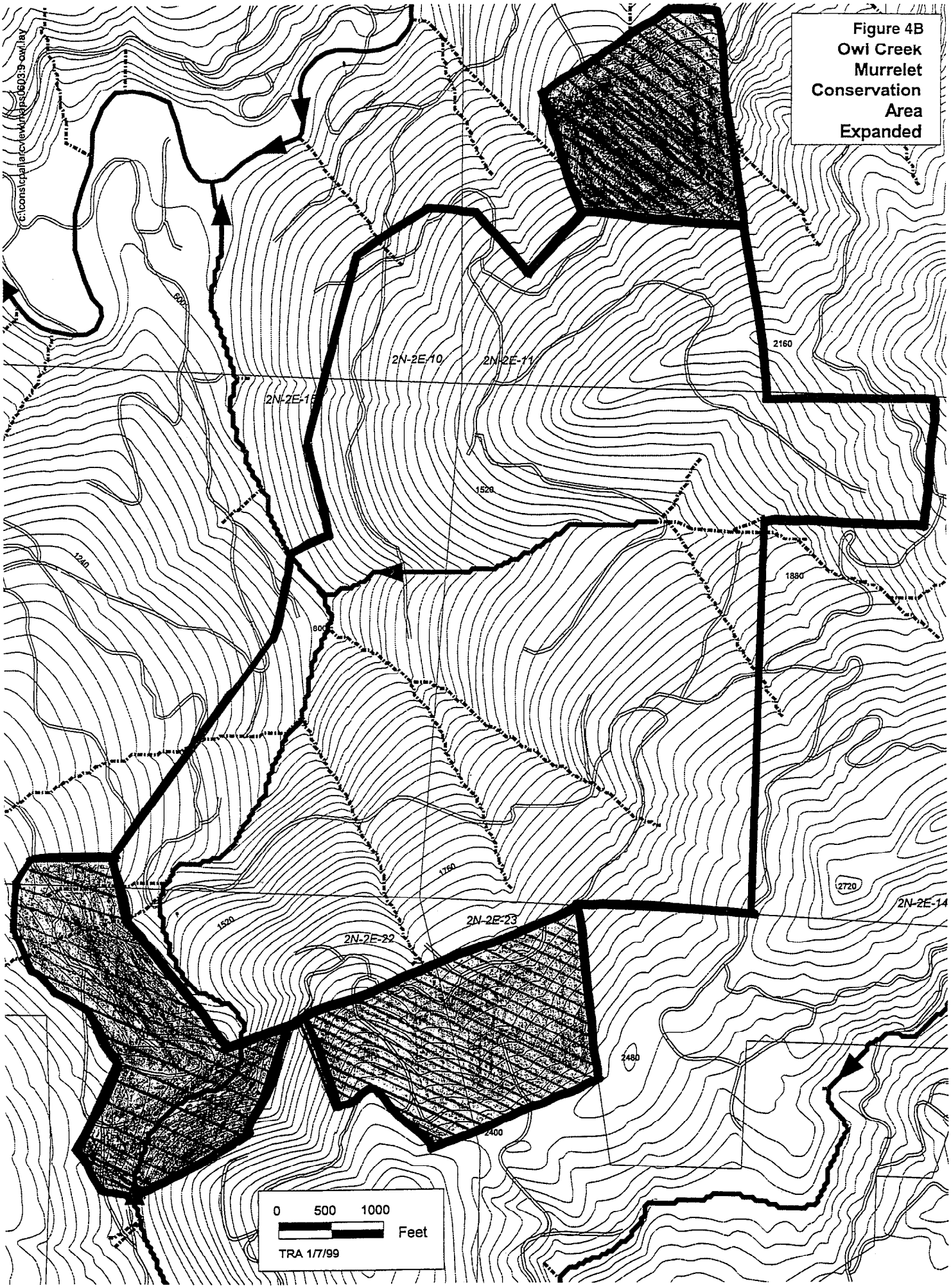


Figure 4B
Owl Creek
Murrelet
Conservation
Area
Expanded
c:\constcpa\arcview\maps\0803-9 owl.lay
2N-2E-10
2N-2E-11
2N-2E-15
2N-2E-22
2N-2E-23
2N-2E-14
2160
1520
1880
1240
800
1760
2720
2480
2400
0 500 1000
Feet
TRA 1/7/99

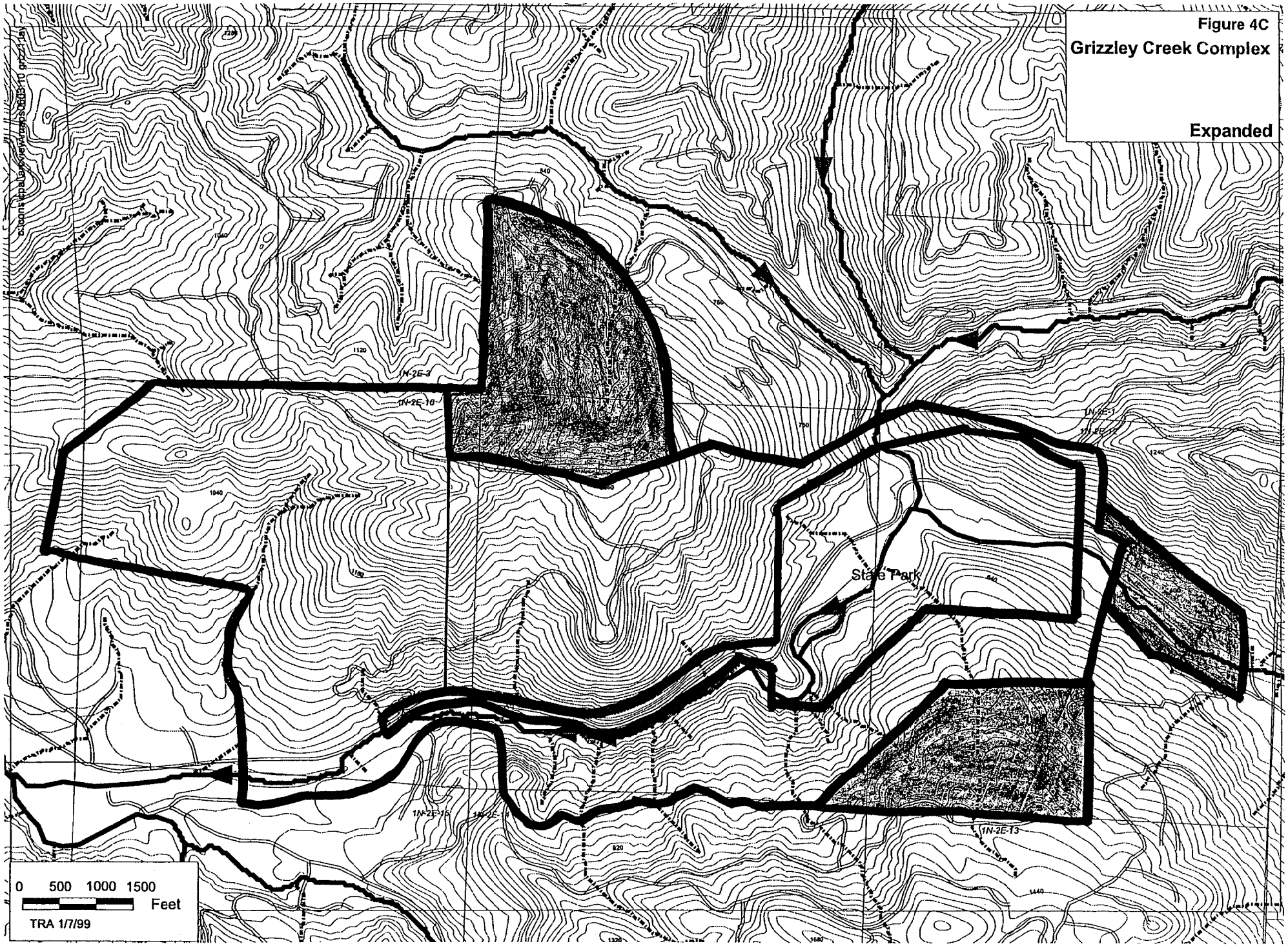


Figure 4C
Grizzley Creek Complex
Expanded
State Park
1N-2E-3
1N-2E-10
1N-2E-13
0 500 1000 1500
Feet
TRA 1/7/99

Table 1
Watershed Assessment Areas
(acres)

Ownership Category	WAA						TOTAL
	1	2	3	4	5	6	
	Humboldt Bay	Yager	Van Duzen	Eel	Bear-Mattole	Other Lands[1]	
PALCO	38,777	34,107	24,934	75,457	34,528	3,903	211,706
Large Industrial	20,148	5,456	9,524	4,036	14,365	0	53,529
Other Private	60,895	44,068	19,998	287,187	204,614	0	616,762
Parks[2]	7,367	23	837	48,930	236	0	57,393
Government[3]	850	900	48	9,768	50,795	0	62,361
Not Classified	553	0	0	568	206	0	1327
Total Area	128,590	84,554	55,341	425,946	304,744	3,903	1,003,078

Ownership Categories

PALCO	Current ownership, excluding lands to be transferred to government ownership and including lands to be transferred to PALCO under the Headwaters Agreement.
Large Industrial	Other large commercial timber landowners.
Other Private	Small commercial timber landowners and other privately-held lands.
Parks	Local, state, and federal parks and reserves.
Government	Non-park federal and state lands.
Not Classified	Ownership could not be determined.

Notes

1 Includes PALCO lands outside the other five WAAs.

2 Includes the proposed Headwaters and Elkhead Springs reserve in the Humboldt Bay WAA.

3 Includes 7,000+ acres administered by the USDA Forest Service in the Eel WAA.

Table 2
Covered (List A) Species

Species Common and Scientific Name	Federal Status	State Status
Focus Species		
Marbled murrelet, *Brachyramphus marmoratus*	FT	CE
Northern spotted owl, *Strix occidentalis caurina*	FT	CSSC, BOF
Chinook salmon, *Oncorhynchus tshawytscha*	FPT	CSSC
Coho salmon, *Oncorhynchus kisutch*	FT	CCT
Cutthroat trout, *Oncorhynchus clarki*	FSR	CSSC
Steelhead/rainbow trout, *Oncorhynchus mykiss*	FSR	CSSC
Other List A Species		
Amphibians		
Southern torrent salamander, *Rhyacotriton variegatus*		CSSC
Tailed frog, *Ascaphus truei*		CSSC
Red-legged frog, *Rana aurora*		CSSC
Foothill yellow-legged frog, *Rana boylei*		CSSC
	(i) Reptiles	
Northwestern pond turtle, *Clemmys marmorata marmorata*		CSSC
Birds		
Bald eagle, *Haliaeetus leucocephalus*	FT, BEPA	CE, BOF, CFP
American peregrine falcon, *Falco peregrinus anatum*	FE	CE, BOF, CFP
Western snowy plover, *Charadrius alexandrinus nivosus*	FT	CSSC
Bank swallow, *Riparia riparia*		CT
Mammals		
California red tree vole, *Arborimus pomo*		CSSC
Pacific fisher, *Martes pennanti pacifica*		CSSC

Codes

BEPA	Bald Eagle (and Golden Eagle) Protection Act	FE	Federal endangered species
BOF	Board of Forestry Sensitive Species	FPT	Proposed for federal listing as threatened
CCT	California candidate for listing as threatened	FSR	Federal Status Review
CE	California endangered species	FT	Federal threatened species
CFP	California fully protected		
CT	California threatened species		

Table 3
Baseline Conditions

Factor	WAA 1	WAA 2	WAA 3	WAA 4	WAA 5	WAA6	
	Humboldt	Yager	Van Duzen	Eel	Bear-Mattole	Other Lands	TOTAL
Seral Type (acres)							
Forest Opening	2,521	989	759	5,454	2,882	11	12,616
Young Forest	6,120	15,282	2,971	12,325	1,804	0	38,502
Mid-successional	12,069	11,014	14,306	25,878	21,140	3,364	87,771
Late Seral	17,461	3,881	5,907	24,440	1,541	6	53,236
Old Growth	71	1,761	153	1,098	3,360	0	6,443
Hardwood	246	221	61	3,010	487	241	4,266
Prairie	0	277	55	973	2,251	281	3,837
Open/Non-timber	289	684	721	2,275	1,069	0	5,038
Site Productivity (acres)							
Site Class 1	516	676	1,388	1,711	43	0	4,335
Site Class 2	37,830	32,098	22,342	68,194	27,739	3,334	191,536
Site Class 3	142	347	460	1,827	2,990	198	5,964
Site Class 8	0	35	14	515	487	89	1,141
Site Class 9	289	954	729	3,206	3,271	281	8,729
Watercourses (stream miles)							
Class I	52	56	30	80	44	3	265
Class II	131	123	83	280	118	16	751
Totals	183	179	114	360	161	19	1,017
WLPZs (acres)							
Class I WLPZs	2,113	2,267	1,256	3,577	1,731	140	11,084
Class II WLPZs	2,995	2,686	1,870	6,312	2,648	356	16,866
Totals	5,108	4,953	3,126	9,889	4,378	496	27,951
Roads (miles)							
Paved/Rocked	117.0	142.7	50.5	181.1	15.1	4.7	511.1
Dirt	163.6	125.7	123.4	388.4	141.6	7.0	949.7
Storm-proofed	9.5	29.1	0	0	0	0	38.6
Reconstructed	8.4	0.5	3.3	16.3	1.6	0	30.1
Decommissioned	0	1.6	0	0	0	0	1.6
Abandoned	0.6	1.3	0	0	0	0	1.9
Total Existing	299.1	300.9	177.2	585.8	158.3	11.7	1,533.0
Proposed (First Decade)	43.1	15.8	14.8	57.1	15.1	0.4	146.3
Existing and Proposed	342.2	316.7	192.0	642.9	173.4	12.1	1,679.3
Surface Erosion Ratings (acres)							
Low	28,471	29,249	15,263	44,354	12,548	1,905	131,791
Moderate	10,201	4,811	9,201	28,964	20,510	1,651	75,338
High	1	20	108	372	1,331	347	2,178
Extreme	104	27	362	1,151	139	0	1,782
No Data	0	0	0	617	0	0	617

Table 3 Baseline Conditions							
Factor	**WAA 1**	**WAA 2**	**WAA 3**	**WAA 4**	**WAA 5**	**WAA6**	**TOTAL**
	Humboldt	**Yager**	**Van Duzen**	**Eel**	**Bear-Mattole**	**Other Lands**	
Landslide Hazard Ratings (acres)							
Very Low	557	302	1,614	5,965	4,894	438	13,770
Low	22,842	6,745	9,036	32,046	8,587	382	79,638
Moderate	8,643	2,681	4,724	21,648	8,743	107	46,546
High	2,195	986	1,868	10,805	7,900	7	23,761
Very High	263	364	532	3,557	4,187	0	8,903
Extreme	0	1	5	146	206	0	358
No Data	4,278	23,028	7,155	1,291	11	2,969	38,731
Disturbance Index (%)	15.5	16.8	5.9	12.8	4.3	Not known	11.5

Table 4 Distribution of List A Species in the Plan Area	
List A Focus Species	
Marbled murrelet	Most old growth and some residual stands in Plan Area considered actual or potential nesting habitat for this species. Occupied behaviors detected in surveys in 26 stands.
Northern spotted owl	Widely distributed in Plan Area; 147 known owl sites on PALCO ownership. Plan Area includes approximately 80,300 acres of high quality nesting habitat, 10,600 acres of medium quality nesting habitat, 70,300 acres of low quality nesting habitat, 10,800 acres of roosting habitat, and 18,000 acres of foraging habitat.
Chinook salmon	Occur in low numbers throughout Plan Area; data on abundance and distribution within individual watersheds varies. Habitat estimated to occur in approximately 82 miles of streams in the Plan Area.
Coho salmon	Known or thought to occur in large number of streams in each Plan Area watershed; data on abundance and distribution within individual watersheds varies. Habitat estimated to occur in approximately 66 miles of Plan Area streams..
Cutthroat trout	Anadromous cutthroat known to occur in Eel River, Strongs Creek in the Eel watershed, in the North Fork Elk River watershed, and Freshwater Creek; data generally not available on occurrence in other areas. Habitat estimated to occur in approximately 31 miles of Plan Area streams.
Steelhead trout	Most widely distributed salmonid in the Plan Area. Within upper Eel WAA, distribution limited by Scott Dam. Data on abundance and distribution within individual watersheds varies. Habitat estimated to occur in approximately 152 miles of streams in the Plan Area.
Other List A Species	
Southern torrent salamander	Widely distributed in suitable habitat in Plan Area. Observed in Bear-Mattole, Yager, Eel, Humboldt, and Van Duzen watersheds.
Tailed frog	Patchy but widespread distribution in suitable habitat in Plan Area. Observed in Humboldt, Yager, Van Duzen, Eel, and Bear-Mattole watersheds. Only the high gradient reaches with substrates of consolidated parent material likely to contain suitable habitat.
Red-legged frog	Based on incidental observations, locally abundant in suitable habitat in the Plan Area. Observed in Eel, Humboldt, and Van Duzen watersheds; presumed to occur in other watersheds.
Northwestern pond turtle	Habitat relatively limited on the PALCO ownership; species detected in or near some of the major watercourses in Yager and Eel watersheds. Pond turtles appear to be present in low numbers in suitable habitat.
Bald eagle	No nest site records for PALCO ownership. Wintering birds rare to relatively common along Yager Creek and the Eel, Elk, and Van Duzen rivers; also seen along lower Larabee Creek, near confluence with Eel River. Seen on PALCO lands generally between November and March (same time as runs of anadromous fish); 3-7 wintering birds seen in Yager watershed, 1-2 in Eel and Humboldt watersheds.
American peregrine falcon	In north coast region, an uncommon migrant and winter visitor; a rare, local breeder (approximately eight known sites in bio-region.), and summer resident. One recorded nest site in Plan Area, on cliff adjacent to Eel River; site may have been damaged or eliminated during the winter of 1995 due to failure of the rock face.
Western snowy plover	Uncommon local migrant and winter visitor; rare, local breeder. Observed in bio-region on inland river bars from the Eel River Delta upstream to at least the mouth of the Van Duzen River.
Bank swallow	On north coast, considered a rare migrant and locally rare breeder. No nesting colonies are known on or near the PALCO ownership.
California red tree vole	Widespread in the Plan Area.
Pacific fisher	Detected in the Plan Area in the multi-species study in the Yager and Humboldt watersheds.

Table 5 Animal and Plant Species Richness by Seral Type		
Seral Type	**Animal Species**	**Plant Species**
Forest Openings	72	88
Young Forests	127	130
Mid Successional	112	122
Late Successional	116	130
Montane Hardwood	76	98
Perennial Grassland	64	62

Table 6. Management Objectives for Northern Spotted Owl Activity Sites

Years After Permit Issuance	Minimum Number Activity Sites
1	145
2	135
3	125
4	115
5	108

Table 7. Wildlife Habitat Relationship (WHR) Habitat Type and Use by Northern Spotted Owls

WHR	3P	3M	3D	4S	4P	4M	4D	5S	5P	5M	5D	6
MHW		LF	LF	LF	MF	LR	MR	HF	LR	HN	HN	HN
MHC		LF	LF	LF	MF	LR	LR	HF	LR	MN	HN	HN
DFR	LF	MF	HF	LF	MF	MR	MN	MF	LR	HN	HN	HN
RWD	LF	MF	MF	LF	LF	LR	MN	HF	LN	MN	HN	HN

USE: L=LOW M=MEDIUM H=HIGH, F=FORAGING R=ROOSTING N=NESTING

Size Class: 3=Pole Tree 6"-11" dbh, 4=Small Tree 11"-24" dbh, 5=Med/Lg Tree >24" dbh, 6=Multi layered habitat

Canopy Closure: P=Open Cover 25-39%, M=Moderate Cover 40-59%, D=Dense Cover 60-100%

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Table 10 Inventory, Growth, and Harvest per Decade			
Decade	**Inventory MBFN**	**Growth MBFN/Decade**	**Harvest MBFN/Decade**
1	5,004,554	177,465	233,519
2	4,453,995	188,200	198,491
3	4,355,315	201,283	173,680
4	4,632,062	216,883	156,312
5	5,224,017	227,967	140,681
6	6,105,130	243,265	154,749
7	6,991,135	243,891	170,224
8	7,713,918	240,116	187,246
9	8,259,261	240,312	205,970
10	8,596,446	233,607	226,567
11	8,661,314	233,372	233,519
12	8,670,639	230,373	227,291

Table 11
Projected Forest Seral Types for the Plan Area by Decade for the Plan Period
(acres)

	Decade												
Seral Type	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
Forest Opening	12,616	30,615	38,175	31,269	31,879	23,179	16,012	19,226	18,460	25,590	28,921	24,091	21,732
Young Forest	38,502	54,062	67,115	74,443	67,661	58,066	66,199	52,453	41,725	49,407	45,546	55,857	58,575
Mid-successional	87,772	80,499	75,468	76,050	81,315	99,298	96,027	102,205	113,422	94,645	98,576	85,214	77,030
Late Seral	53,236	32,433	18,105	17,710	18,793	19,129	20,973	25,442	25,743	29,675	26,191	34,010	41,886
Old Growth	6,444	3,864	3,564	3,295	2,983	2,965	2,136	2,136	2,136	2,136	2,136	2,136	2,136
Hardwood	4,266	1,362	409	68	204	198	1,489	1,373	1,350	1,382	1,465	1,528	1,477
Prairie	3,832	3,832	3,832	3,832	3,832	3,832	3,832	3,832	3,832	3,832	3,832	3,832	3,832
Non-timber	5,038	5,038	5,038	5,038	5,038	5,038	5,038	5,038	5,038	5,038	5,038	5,038	5,038

Table 12

Estimated Forest Seral Types in Class I WLPZs by Decade for the Plan Period

(acres)

	Decade												
Seral Type	*0*	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*11*	*12*
Non-Timber	1018	1018	1018	1018	1018	1018	1018	1018	1018	1018	1018	1018	1018
Prairie	96	96	96	96	96	96	96	96	96	96	96	96	96
Forest Opening	294	1	1	1	1	1	1	32	5	13	1	1	1
Hardwood	230	147	31	17	57	57	60	58	60	172	187	202	200
Young Forest	1375	1858	1225	399	124	60	103	70	259	272	80	19	9
Mid-Successional	4433	4503	4983	5750	5451	5240	4390	3359	2417	2384	2100	2167	2434
Later Seral	3133	3064	3435	3520	4069	4355	5158	6194	6972	6871	7344	7324	7069
Old Growth	505	398	296	285	268	258	258	258	258	258	258	258	258
Total	11084	11085	11085	11086	11084	11085	11084	11085	11085	11084	11084	11085	11085

Table 13

Estimated Forest Seral Types in Class II WLPZs by Decade for the Plan Period

(acres)

	Decade												
Seral Type	*0*	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*11*	*12*
Non-Timber	342	342	342	342	342	342	342	342	342	342	342	342	342
Prairie	105	105	105	105	105	105	105	105	105	105	105	105	105
Forest Opening	415	1	1	1	1	1	1	22	4	9	1	1	1
Hardwood	366	288	73	13	6	5	35	45	48	164	225	225	221
Young Forest	2467	3068	2040	819	312	122	123	101	456	349	126	40	21
Mid-successional	7834	8047	8632	9788	9024	8541	6583	4630	3672	3365	2988	2988	2811
Late Seral	4667	4475	5331	5477	6756	7438	9332	11310	11928	12220	12854	12854	13054
Old Growth	670	540	343	322	321	312	312	312	312	312	312	312	312
Total	16866	16866	16867	16867	16867	16866	16833	16867	16867	16866	16953	16867	16867

ATTACHMENT 1

VOLUME II, PART B - PALCO OWNERSHIP BY ASSESSOR PARCEL NUMBER

Attachment 1: Volume II, Part B - PALCO Ownership by Assessor Parcel Number

Parcel Number	Parcel Number	Parcel Number	Parcel Number
20001102S	10315205	10702502	20501134
20001104S	10316101	10702601	20502101
20401203	10316102	10702606	20502102
20601108	10316103	10703102	20502103
31107302	10316201	10703201	20502124
31108102S	10316202	10703301	20503117
31108201	10316203	10703401	20503121
31108202	10316205S	10703501	20503123
31108302S	10316206S	10703602	20503124
31109101S	10316207	10704102	20503150
31109102	10317103	10704103	20503151
31109203	10317204	10704104	20503152
31404303	10318104	10704105	20504140
31404401	10318105	10704201	20505101
31405101S	10318106	10704301	20505102
31405201	10318203	10704402	20505103
31405202S	10318206	10704501	20505106
31405303S	10318207	10722307	20505108
31405402S	10319203	20001105	20505110
31405403	10326203	20001106	20506102
31405405	10327202	20001107	20506103
31406101	10327203	20001109	20506104
31406104S	10328101	20001110	20506107
31406403S	10328201	20001116	20506111
10212203	10329101	20001117S	20507105
10215205	10329105	20001118	20524101
10301103	10329201S	20203101	20526106
10301104	10329202S	20203102	20531101
10301105	10329203	20219101	20531102
10301106	10329204	20220101	20531104
10301108	10420103	20221102	20532102
10301109	10420202	20401101	20532106
10301202	10421105	20401202	20532121
10301203S	10421106	20401301S	20532128

Parcel Number	Parcel Number	Parcel Number	Parcel Number
10301205	10421109	20401302	20532133
10302102	10421110	20402101	20532135
10302202	10421111	20402102	20533101
10303202	10421211	20402201	20533102
10303203	10618130	20402202S	20533103
10303206	10618134	20402301	20533104
10303207	10619103	20402302S	20533105
10313103	10619106	20403101	20533106
10314208	10620105	20403305	20533107
10315101	10701101	20403307S	20534101
10315102	10701203	20403403	20534102
10315103	10702104	20405202	20534103
10315201	10702201	20405203	20534104
10315202S	10702301	20405204	20534105
10315203	10702402	20405205	20534106
10315204	10702501	20414101	20534107
20534108	20612102	20721101S	20920103
20534111	20612103	20721102	20920104
20534112	20612104	20721202	20920107
20534118	20612105	20721203	20920108
20601104	20612117	20721303	20920110
20601105	20612118	20721304	20920112
20601106	20612120	20721305	20921103
20601107	20612121	20721401	20921105S
20602101	20613101	20722103	20921106
20602102	20613102	20723103	20921107
20602103	20613103	20723104	20921108
20602104	20613104	20723105	20921109
20602105	20614107	20723107	20921110
20602106	20616101	20723110	20921111
20602107S	20617104	20723201	20921112
20603102	20617109	20723202	20921113
20603103	20619109	20723203	20923108
20603104	20619117	20723204	20925101
20603105	20626201	20723206	20925102
20603106	20626203	20723207	20925103
20603108	20626204	20723209	20926101
20603109	20626205	20723301	20926102
20604101	20626207	20813503	20926103

20604102	20626209	20813504	20926104
20604114	20626210	20814101	20927104
20605112	20626213	20814102	20927105

Parcel Number	**Parcel Number**	**Parcel Number**	**Parcel Number**
20605113	20626220	20814110	20927113
20605116	20627101	20814111	20927114
20605118	20627102	20814209	20927115
20605119	20627104	20814301	20928104
	20627105	20814303	20928108
20605122	20627106S	20814304	20928109
20605123M	20627113	20814305	20935117
20605126	20627114	20907101	20935124
20605127	20627115	20907103	20935138
20606104	20627117	20907104	20935170
20606105	20627120	20907108	20935181
20606106	20627122	20908121	20936101
20606107	20627123	20908122	20936116
20606116	20627125	20908126	20937101
20606121	20627126	20916206	20937102
20606122	20628104S	20918103	20937103
20606123	20629112	20919101	20937104
20606124	20705602	20919102	20938103
20606125	20708101	20919103	20938105
20607101S	20708201	20919104	20938106
20607102	20708602	20919111	20938107
20607103	20712106	20919112	20938110
20610101S	20712601S	20919113	20938112
20610118	20712603	20920101	20938115
20610133	20712604S	20920102	20938116
20939101	21104202S	21145104	31403401
20939102	21104203	21145105	31403402S
20939103	21104301	21145201	31403501
20939109	21104302S	21145202	31403503S
20939110	21104303	21145204	31403601
20939111	21104304	21145302	31404101
20939114	21104305	21145303	31404202
20939115	21105303	21145304	31404301
20939116	21106101	21145305	31404601
20939117	21106201	21146101	31405302S
20939118	21106202	21146204	31405404

20939119	21106203	21147101	31406203S
20939120S	21106204	21147201	31406204
20939121	21106205	21148107	31406205
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Parcel Number	**Parcel Number**	**Parcel Number**	**Parcel Number**
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21101204	21127506	21701202	31408407
21101205	21127512	21701301	31408408
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21101302	21127608	21701409	31408601
21102302	21128201	30401104	31408602S
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21103104	21129401	31401301	31409401
21103201	21129501	31401401	31409501
21103203	21130201	31401501	31409601
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21104102	21131101	31402501	31411202
21104103	21131112	31402601	31411205
21104104	21145101	31403101	31411304
21104105	21145102	31403201	31411401

21104201	21145103	31403301	31411502
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31413128	40532111	10707304	20503149
31413132	40532114	10707502	20505109
31413139	40532115	10707505	20506112
31416103	40604105	10707601	20521211
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21720108	31408302	40528108
21720110	31413107	40532113
21720217	31413131	50112120
21720220	31413134	51623110
21720221	31413150	51623111

ATTACHMENT 2

VOLUME II, PART E - ASSESSMENT OF WATERSHED DISTURBANCES AND RECOVERY

Attachment 2: Volume II, Part E - Assessment of Watershed Disturbances and Recovery

b. Purpose, Background, and Approach

1)

2) Purpose

To evaluate and minimize the level and impact of land use-related disturbances in managed watersheds on the ownership, specifically as they relate to accelerated erosion and sediment yield. To estimate the current disturbance regime and to predict future levels of disturbance and recovery based on harvest planning scenarios contained in the sustained yield model.

3)

4) Background

Land use activities often result in the alteration of natural physical and biological watershed attributes. The nature, severity and persistence of site disturbance resulting from a land use activity is often difficult to quantify, because it is a function of several variables, including 1) the type of land use activity, 2) where in the watershed the land use activity is conducted, 3) how well the activity is done and 4) the natural geomorphic sensitivity of the landscape. These factors make quantification difficult. For this reason, normalized, numerical disturbance coefficients can be used to track and predict relative land disturbance within watersheds. The coefficients are used as first-cut estimates of land disturbance as they relate to probable mechanisms for initiating watershed and stream channel response, specifically related to erosion and sedimentation problems. The initial selection of land disturbance coefficients relies on interdisciplinary professional judgment, and values can be refined based on known site conditions, field observations, published values, and aerial photographic analysis.

5)

6) Approach

Disturbance coefficients can be developed to express the effect of land use on such variables as woody debris recruitment, hillslope stability and sediment flux, and changes in watershed hydrology. We have chosen to develop a land use disturbance index that, when combined with a watershed sensitivity index, provides a relative measure of the potential effects of land use on the geomorphology and, by inference, to the aquatic resources of each drainage basin in the ownership. Ground disturbance, for this analysis, is considered as one measure of the potential for initiating erosion and sedimentation problems in managed watersheds. In general, the greater the ground disturbance of an operation, the greater the likelihood there will be resulting erosion and sediment yield to stream channels.

Tasks

The determination of relative levels of watershed disturbance, for these purposes, is a fairly straight forward procedure involving the identification of harvest management practices (yarding

techniques and silvicultural methods) and the application of multipliers to identify which areas have been disturbed to the greatest degree. Thus, yarding operations involving tractors and other ground skidding equipment are the most likely to cause the greatest unit ground disturbance (soil displacement/acre). They are also most likely to have haul roads located in the more sensitive lower slope positions. In contrast, unassisted helicopter yarding is likely to cause the least soil disturbance of modern yarding methods, and haul roads are normally located on ridge-tops where erosion and sediment problems are less likely to occur. Similarly, the greater the silvicultural intensity, the greater the chance that soil loss will occur. Thus, clear cutting is likely to produce more land disturbance, and increase the potential for soil movement and erosion, than a commercial thinning operation on the same terrain, all else being equal.

The calculation procedure outlined in this report provides a simple method to evaluate the relative landscape disturbance caused by a variety of yarding and silvicultural methods in a watershed. The numbers have no concrete meaning except in their relative relationship to one another. Taken together, they provide an relative index of the degree of management-related disturbance in a watershed, and therefore provide a useful assessment and predictive tool for land use planning. Finally, land use disturbances and their effects tend to diminish over time. Recovery rates for vegetation are comparatively rapid in coastal watersheds and surface erosion on disturbed soils diminish quickly after the first few years. For simplicity, 10 and 20 year recovery periods were selected for analysis, depending on the availability of harvesting history data and yarding information (see discussion on site recovery, below).

How much disturbance is too much for a particular watershed depends on a variety of factors. These include watershed sensitivity (see Geomorphic Sensitivity analysis), the location of the disturbance, the type of disturbance, the duration of the disturbance and the age of the disturbance. Thus, disturbance is important not only in its magnitude, but also where it occurs, its aerial extent (relative to streams and other sensitive locations), when it occurs and over what time period. These are all factors that relate to its effect on erosion and sedimentation problems in a watershed.

Uses and Limitations

There are several methods available to reduce the potential adverse effects of land use in a geomorphically sensitive watershed. Since natural watershed sensitivity cannot be easily altered, these measures either entail 1) the use of modified land use practices to reduce the level of watershed disturbance related to land use activities from one watershed to the next, or 2) employing remedial or corrective measures to improve conditions associated with past activities.

Modified land use practices*:* The first type of measures are accomplished during project planning (by such techniques as avoidance of problem areas, special project layout, and special or restrictive design), during project implementation (by such things as operator and equipment selection, and special operating practices), and during the post-project phase (using special remediation and erosion prevention practices). Numerous mitigation measures and best management practices can be employed to reduce site-specific watershed impacts. These often go beyond the requirements of

existing regulation and are employed to provide an added measure of protection to sensitive watersheds within the ownership.

***Remedial measures**:* Secondly, remedial measures can also be employed to reduce the potential for adverse effects from land use in sensitive watersheds. These measures might include road upgrading and storm-proofing (surfacing, outsloping, drainage improvement, etc.), road decommissioning (planned closure, either temporary or permanent), erosion control work, landslide stabilization and stream channel improvement projects. Pacific Lumber Company is currently employing a variety of these measures on a site-specific basis, and their use is expanding as heavy equipment is upgraded and personnel are trained.

Site Recovery

Most areas disturbed by land use tend to return towards their natural state over time, depending on the nature and magnitude of the disturbance. Some land use, such as road construction, will continue to have some effect for as long as the feature exists in the watershed.

In reality, recovery is probably a non-linear process in nature, and some elements which influence geomorphic recovery are episodic, like the climatic events that control much of landform development. An example of the non-linear recovery is the change in root shear strength following clear cutting of Douglas-fir forests. Root strength drops off in a non-linear decline for a number of years following harvest, but then picks up again as the root systems from the young second growth forest begin to reestablish.

Similarly, surface erosion of bare soil areas does not diminish in a linear fashion, but probably increases following disturbance and then drops off exponentially as an armor develops and vegetation is reestablished. Different geomorphic settings and processes also recover at different rates. Thus, surface erosion may return close to background within several years, but heavily aggraded stream channels may take decades to flush their stored sediment and recover their natural morphology. Many erosional processes are controlled (driven) by episodic hydrologic events and their recovery is dependent on the magnitude and frequency of storms following the initial disturbance.

The lack of data required to develop accurate curves for various components of watershed recovery, and the complexity of watershed recovery processes, limits the use of non-linear recovery models. Instead, a linear recovery model is often used to estimate the overall duration of watershed impacts from land use. Because revegetation rates are very high in most coastal watersheds of the Company's ownership, we have selected a simple linear recovery model with which to evaluate watershed recover over time. Rapid revegetation and resprouting helps reduce both landslide risk and surface erosion rates, and it masks the subtle non-linear recovery processes than might be more apparent in dryer and higher inland watersheds.

Site recovery is affected by several variables, and can refer to both recovery from past practices and recovery from future land use activities. Natural recovery from *past* land use depends on the nature of the land use (e.g., an old road with Humboldt crossings, which wash out slowly, or culverted crossings, which wash out comparatively quickly), the time elapsed since land use, and the frequency and magnitude of storms which have occurred in the watershed since the disturbance. Certain types of storm-triggered erosion and sedimentation problems can occur a decade or more

after the time of initial land use disturbance. Recovery from past land use can be dramatically accelerated through a program of problem identification and implementation of erosion prevention work such as that being conducted in our "road armoring" program.

The nature and duration of effective site recovery from ***future*** land use is also dependent on a number of variables, including operator "care," project location, the magnitude and frequency of post-project storm events, revegetation rates, and other factors. For example, vegetative recovery (from a hydrologic perspective) is likely to be much more rapid within the coastal influence area than for areas further inland. Effective hydrologic recovery may take 30 years or more in inland watersheds or in areas dominated by rain-on-snow events, but be much quicker in low elevation coastal watersheds.

Other factors are also likely to be important in determining recovery rates, including the type and location of disturbance. For example, surface erosion can be expected to diminish rapidly in the first few years following disturbance in the wet coastal region. Similarly, ridge-top disturbances (e.g.., ridge roads) are less likely to result in significant impacts to the aquatic system (compared to midslope or lower slope roads) and overall recovery from this type of "distant" disturbance will be relatively rapid.

7)

8) Conclusions

Developing a simplistic disturbance index for the ownership allows us to evaluate the relative magnitude of present watershed disturbance in context with the existing aquatic conditions of our streams. It is a tool that will help us evaluate our past practices and to take steps and make improvements anywhere conditions might have deteriorated to unacceptable levels. It is also a tool that allows us to predict the outcome of future forest management activities (harvesting and yarding) that are suggested by the sustained yield plan.

Perhaps more importantly, a relative disturbance index for forest practice activities on the property can be used in conjunction with the watershed sensitivity assessment to broadly guide future land management in a fashion that minimizes disturbance to potentially sensitive terrain and thereby reduces the potential for accelerated erosion and sediment yield to streams. It is a planning tool that will be most successful when used in conjunction with the broad array of on-the-ground watershed protection and recovery practices now being implemented.

c.

d. SYP/HCP Disturbance Index

The primary assumptions underlying the disturbance index (DI) developed for the SYP/HCP are that:

- Different types and combinations of timber management activities and yarding methods produce different levels of sediment; and
- Sediment production from a given activity diminishes over time.

As in the ERA approach, each type of silvicultural activity was assigned a disturbance rating that reflects the intensity and duration of its effects (Table 1). In general, the greater the ground disturbance, the greater the risk of erosion and sediment yield, and the higher the disturbance

rating. In this regard, the DI and ERA ratings are very similar. However, the DI is customized to give a higher disturbance rating than the ERA approach to tractor yarding. In addition, instead of treating roads as a separate factor, the DI correlates roads with the yarding methods.

As in the ERA approach, the DI also considers the diminishment of impacts over time, with the DI using a 10-year time factor and ERA using 30 years. It must be emphasized, however, that neither the DI nor the ERA time lines should be construed as being the actual time to recovery. In both approaches, the time factor allows for comparative analysis of cumulative impacts from proposed activities. Further, a 10-year DI time factor was selected for reasons connected to SYP planning and implementation. PALCO has detailed information on silvicultural activities for the past ten years (1986-1996), and that information can be used to calculate a baseline DI for the plan area. The baseline DI in turn can be used as a point of comparison for impacts from activities under the LTSY projection (presented in 10-year intervals).

To calculate the DI for a given area (e.g., PALCO lands within a WAA or the area covered by a THP), the silvicultural practices and yarding methods used in the area over the past 10 years and the number of acres where each treatment occurred are identified. The acres of a treatment are multiplied by the disturbance rating for the silvicultural practice and by the rating for the yarding method. This product is then multiplied by the time factor (10 minus the number of years elapsed since the treatment occurred) and divided by 10. The sum of the results for each treatment is then calculated and divided by the total acres in the area, expressing the DI as a percentage. Table 2 provides a sample calculation for a 500-acre area.

TABLE 1
DI RATINGS FOR TIMBER MANAGEMENT ACTIVITIES

Silviculture Practice	Rating	Yarding Method	Rating
Clearcut	1	Tractor	1
Overstory Removal	0.7	Cable Skyline	0.6
Seed Tree Step	0.7	Tractor and Cable	0.7
Seed Tree Removal	0.7	Salvage	0.7
Shelterwood Preparation Step	0.5	Unknown	0.7
Shelterwood	0.6	Cable Highlead	0.7
Shelterwood Removal	0.7	Helicopter	0.4
Rehabilitation	0.7		
Commercial Thin	0.5		
Selection	0.5		
Transition	0.6		
Alternative	0.5		
Salvage	0.3		

TABLE 2
SAMPLE DI CALCULATION FOR 500-ACRE AREA

Acres	Silviculture Practice (rating)	Yarding Method (rating)	Date of Activity (time factor)	Current Impact Rating
200	clear cut (1)	tractor (1)	1988 (10-9)	20
50	selection harvest (.5)	helicopter (.4)	1993 (10-4)	6
150	overstory removal (.7)	tractor (1)	1995 (10-2)	84
100	not managed since 1985			0
			Total Impact Rating	110
			DI for the 500-acre Area	**22%**

ATTACHMENT 3

VOLUME II, PART 0 - ASSESSMENT AND IMPLEMENTATION TECHNIQUES FOR ROAD-RELATED SEDIMENT SOURCE INVENTORIES AND STORM-PROOFING

Attachment 3: Volume II, Part O - Assessment and Implementation Techniques for Road-related Sediment Source Inventories and Storm-proofing

1) Upland Watershed Sediment Source Assessments

There is recent, growing recognition that effective fisheries protection and restoration, and the long term recovery of gravel-bedded anadromous fish streams, is directly dependent on the recovery and healing of eroding hillslopes and tributary streams in upland areas of a watershed (Weaver and Hagans, 1990; PRC, 1992; Harr and Nichols, 1993). Similarly, cost-effective erosion prevention projects conducted on logged and roaded hillslope areas throughout a watershed can protect healthy stream channels from future impacts (Weaver and others, 1987b; Weaver and Sonnevil, 1984; Harr and Nichols, 1993).

A watershed sediment source assessment and erosion prevention planning project entails the delineation of treatable, persistent or potentially episodic sources of eroded sediment which contribute or threaten to deliver significant quantities of sediment to streams. The assessment entails delineating past and future sediment sources in the watershed, and describing how sediment is eroded, and how it moves into the stream channel system. It is important to learn how much sediment is coming from each of the major erosion processes (e.g., landslides along roads, and stream crossing washouts), and how much of that is amenable to control or prevention.

The inventory process is similar to a "modified" sediment budget analysis (Dietrich and Dunne, 1978) where sediment delivered to the streams in a watershed is identified and quantified. However, the sediment source assessment targets future sediment sources (rather than what has happened in the past) and its primary focus is to identify and prioritize all potential sources of erosion and sediment yield that are amenable to treatment. Sources of past erosion and sedimentation are identified during the assessment process, but they are of interest mostly in what they tell us about similar areas that have not yet failed but may yield sediment in the future.

There are three main objectives of a sub-watershed sediment assessment project. The objectives, and the tasks carried out to complete them, include:

1. Conducting a physical inventory of existing and potential sediment sources which are likely to deliver sediment to the sub-watershed and its tributary streams if they are not treated;
2. Developing a practical, fact-based, prioritized listing of cost-effective erosion control and erosion prevention projects. These projects are recommended to provide for long-term protection of fish- and non-fish bearing stream channels in the sub-watershed, its tributaries and in downstream areas, and;
3. Analyzing the erosional effects of past and current land management and land use practices in the watershed, with the goal of developing possible changes in land

management practices, techniques or intensities that could reduce the future delivery of sediment to streams.

In most upland forest watershed inventories and assessments, logging roads are initially singled out in the analysis both because the road network provides ready access for heavy equipment to reach potential work sites, and because roads have been identified throughout the region as serious, treatable sediment sources themselves. Studies conducted in the coastal and Cascade mountains of northern California, Oregon and Washington have found roads to be a primary, land use-related contributor to on-site erosion and downstream sediment yield that impact fish bearing streams (Swanson and Dyrness, 1975; Swanston and Swanson, 1976; Dyrness, 1967; Reid, 1981; Weaver and others, 1981a; Frissell and Liss, 1986; Fiksdal, 1974; Farrington and Savina, 1977; LaHusen, 1984; Hagans and others, 1986; Weaver and others, 1987b; Pacific Watershed Associates, 1994a,b). As discussed previously, these impacts become most apparent in response to large storms and floods which trigger watershed-wide erosion and geomorphic change.
Stream crossings, log landings, oversteepened sidecast and road fills built in "suspect" geomorphic locations are prime areas where cost-effective erosion prevention projects can keep large quantities of sediment from entering streams and being transported to important spawning and rearing areas (Weaver and others, 1987b; Harr and Nichols, 1993).

Conducting an Upland Watershed Assessment
It is necessary to follow an organized, systematic series of steps in assessing watershed sediment conditions. Only then can you ensure that erosion control and erosion prevention work will treat those sources of future erosion and sediment yield that could be effectively controlled for the lowest expenditure. It is not cost-effective to take the shot-gun approach, where problem areas are randomly identified and treated without regard to their importance in overall watershed health or to our ability to cost-effectively control or prevent stream sedimentation.

1) Air photo analysis: As the first step, an air photo analysis of the watershed is conducted to help reveal the location of sensitive roads and other high priority areas for further field mapping, analysis and potential treatment. It is important to identify all the roads that have ever been constructed in the watershed, whether they are currently maintained and driveable, or are now abandoned and overgrown with vegetation. When possible, historic aerial photographic coverage from a number of years (perhaps one or two flights per decade) should be selected to “bracket” major storms in the watershed. This will allow the identification of roads which have been “storm-tested,” and closer analysis will reveal at least some of the most obvious erosional consequences of storm (stream crossings washouts, landslides, debris torrents, etc.). A preliminary transportation plan is developed for the watershed at this time, outlining the best long term permanent and seasonal road network needed to manage natural resources.
2) Field assessment and prioritization: Second, major, potentially treatable or preventable sources of erosion and sediment yield are identified through field inventories and prioritized for treatment during field mapping. In high priority watersheds, efforts are made to delineate which roads pose high risk of accelerated or chronic sediment production and delivery, or high long term maintenance costs, and which might be excellent candidates

for decommissioning (proper "hydrologic closure," not just barricading or blocking to traffic). The preliminary transportation plan is revised and finalized following this field inventory phase.

3) Prescription development: Once sites are identified and prioritized, general prescriptions for erosion control and erosion prevention are developed for each major source of treatable erosion that, if left untreated, would likely result in sediment delivery to streams. Sediment which is contributed to small streams can be as important as that which is delivered directly to major fish-bearing watercourses, since all sediment which enters upland streams will eventually be transported downstream to channels with fish habitat. Generalized prescriptions which should be identified during the field inventory include types of heavy equipment needed, equipment hours, labor intensive treatments required, estimated costs for each work site and expected sediment savings.

4) Treatment recommendations: In the final step of the assessment, a report and plan is developed which outlines recommendations and pinpoints areas within each watershed which would benefit most from cost-effective erosion control and erosion prevention work. In addition, recommendations are made on how on-going land use practices in the watershed might be further modified to reduce the threat of future erosion and sediment yield from on-going land management activities.

We believe requiring proposed work to meet pre-established cost-effectiveness criteria is critical to developing a defensible and objective watershed protection and restoration program. *The cost-effectiveness of treating a work site is defined as the average amount of money spent to prevent one cubic yard of sediment from entering or being delivered to the stream system* (Weaver and Sonnevil, 1984). By using this evaluation methodology a variety of different techniques and proposed projects can be compared against each other using the same criteria: reducing accelerated erosion and keeping eroded sediment out of the watershed's streams.

If a watershed sediment assessment is done well, the logical next step will be for skilled equipment operators, laborers and erosion control specialists to immediately implement those projects deemed most cost-effective and most beneficial to long term watershed health and the protection of fisheries resources. Implemented projects can consist of erosion control and erosion prevention work, as well as changes in land use practices (another form of proactive erosion prevention). Pacific Lumber Company generally implements those moderate and high priority sites with a predicted cost-effectiveness of $\$8/yd^3$ or less.

Effective watershed stabilization must incorporate both erosion control and erosion prevention work, in concert with protective land use practices. *Erosion control* practices for steep forested lands impacted by logging and road building have been thoroughly tested and evaluated and are applicable for most steepland areas (Sonnevil and Weaver, 1981; Weaver and Madej, 1981; Weaver and others, 1981a; Weaver and Sonnevil, 1984; Weaver and others, 1987a; Harr and Nichols, 1993). Projects which provide for *erosion prevention* are by far the most cost-effective means of protecting fish habitat and entail the recognition and treatment of potential sediment sources before they become contributors to sediment yield. Finally, simple *changes in common land use practices* (such as road and landing construction, road maintenance techniques and road abandonment practices) can often go a long way to preventing unnecessary, accelerated erosion in

the future. Many of these practices, as related to forest road systems, are outlined in the appendix "Guidelines for Forest Roads and Landings."

Sequence of Assessment Work Tasks and Data Collection Procedures

The upland watershed sediment source assessment involves several discrete steps or stages. These steps are a necessary precursor to on-the-ground watershed protection and restoration work which is to be undertaken in the future. They ensure that the most critical, cost-effective erosion prevention and erosion control projects in the watershed are undertaken first.

Phase 1: Air photo analysis. The first step is to assemble and analyze historic aerial photographs, maps, digital mapping data, GIS information and relevant literature available for the watershed. This data is used to construct accurate road maps and to create a general land use and erosion history of the assessment area or sub-watershed, including road locations, road construction history, landslide locations and mass movement history, "road-related" erosion (stream crossing washouts, gullies and landslides, where visible), expected locations of all stream crossings and the location (and timing) of streamside landslides. Stream flow records for this or nearby watersheds are also reviewed to determine information on the magnitude and frequency of historic floods.

An enlarged version of the 7½ minute USGS quadrangle(s), taken from digital map data, is used as the base for identification and location of roads, watersheds and property boundaries in the assessment area. Enlarged versions of the 7½ minute USGS quadrangles can be used to plot road locations, mapped sites and treatment locations. Pacific Lumber Company has sufficient GIS capabilities to produce accurate base maps. Every road that is identified from the aerial photo analysis is then scheduled for field assessment to identify both past and future sediment sources.

Aerial photographs used for field mapping are typically 1:12,000 scale (1 inch equals 1,000 feet), color or black-and-white 9"x9" vertical photos flown as recently as is possible. This is a good scale to employ, as smaller scale photos (e.g., 1:20,000) often do not provide sufficient clarity or detail. Recent photos are often available in true color. The latest photos available for P-L lands are only several years old and new images will be taken in June, 1997. Historic black and white aerial photographs taken in earlier years, beginning in the 1940's, provide a time sequence of images used to isolate periods of harvesting, road building, road abandonment and erosion (especially landsliding) in the watershed.

Phase 2: Field assessment (inventory). Phase two of the watershed sediment source assessment involves field inventories and site analyses. Several levels of field inventory and assessment are carried out. Detailed inventories of all maintained and abandoned road systems are used to identify and determine past and future contributions of sediment to the stream system, and potential treatment sites. The most critical areas and road systems identified during the air photo analysis are inventoried and evaluated in the greatest detail.

For the detailed field assessment, acetate overlays are attached to each 9" x 9" aerial photograph and used to record site location information as it is collected in the field. Information recorded on these overlays includes road location, site number and location (road mileage), type or

classification of site, erosional features (stream-side landslides, debris torrents, potential debris slides, gullies and gullied stream channels, washed out stream crossings, etc.), stream channels, stream crossings, landings and all culvert locations. GPS (global positioning) technology is also be used to identify the location of sites for GIS (computer mapping) applications.

A computer database (data form) is then developed and more detailed information is collected for each site of potential sediment yield identified in the field. Depending on the classification of a site (stream crossing, debris slide, gully, road and cutbank erosion, streamside slides, etc.), different portions of the database form are filled in with the relevant information. Basic information is collected for every site.

Identified sites are first classified according to their potential for sediment delivery to stream channels. Very small sites are often not worth inventorying separately, unless they become cumulatively significant (such as road ditches). Past inventories (e.g., Weaver and others, 1981a) have shown that it is typically the larger sites that account for most of the accelerated (land use related) sediment yield from a watershed. Therefore, it is important to identify a lower threshold of sediment yield below which a site is not identified in the field inventory. In most watersheds, this minimum site size may range from 10 yds^3 to 50 yds^3, depending on the watershed. In large watershed inventories, it is often sufficient to identify those sites where there is a potential to yield at least 25 yds^3 or 50 yds^3 of sediment to a stream channel (excluding the more diffuse sediment sources such as road surfaces, ditches and cutbanks).

During sub-watershed inventories, special attention is paid to all major stream crossings, all stream crossings with a high diversion potential (DP) and stream crossings with a high failure potential (FP)(e.g.., undersized culverts). Based on past inventory work, each of these categories of stream crossings are assumed to have a high potential for delivering sediment to stream channels, particularly if they are located on roads that are abandoned or no longer receive frequent maintenance. Erosion and failure of stream crossings on abandoned and unmaintained roads, in particular, is likely to eventually occur when culverts plug during large storms. Once erosion has been initiated, sediment lost from these locations will be delivered directly into low order stream channels and, eventually, to the larger fish-bearing streams.

Visibly unstable fillslopes, unstable log landings and unstable hillslopes crossed by either abandoned or maintained logging roads are also described, especially if they threatened to deliver sediment to a downslope stream channel. To be visibly unstable, the identified site usually exhibits tension cracks, vertical scarps, excessive sidecast on steep slopes, springs, leaning trees, or other geomorphic evidence suggesting past or pending slope failure.

The erosion potential, the potential for sediment delivery and the potential for rare, but extreme amounts of erosion are estimated for each major problem site or potential problem site in the watershed. The past and future expected volume of sediment to be eroded, and the volume to be delivered to streams, is also be estimated for each site. The data tells not only how much has been eroded and delivered from existing sites, it also provides estimates on how much will be eroded and delivered in the future, if no erosion control or erosion prevention work is performed. In some locations, future sediment loss could exceed field predictions. At the same time, some inventoried

features which show signs of pending or potential failure may never move or deliver sediment to stream channels.

Finally, in addition to erosional features along roads, selected portions of tributary streams within each sub-watershed assessment area are inspected for signs of bank instability, past stream side landsliding or future bank failures. The volume of both past and future erosion and landsliding is estimated and logged on a data form, as well as any obvious associations with past or on-going land management activities, so that initial estimates of the volumetric importance of each erosion process (a sediment source assessment) can be developed. In addition, some of these stream side sites may also be amenable to treatment and stabilization.

Phase 3: Prescribing treatment. During the field inventory of existing and potential erosion sources, a more detailed analysis of each significant site is performed. This step includes an analysis of the most effective and cost-effective erosion prevention and/or erosion control work that could be applied to each of the sites recommended for treatment, including all sites classified as having a high, moderate or low priority for treatment. *Recommended treatments are generally prescribed only for sites with a potential for future erosion and sediment yield because they are the only ones capable of delivering sediment to downstream fish-bearing stream channels.*

The analysis of each recommended treatment site includes generalized heavy equipment and labor-intensive prescriptions, as well as procedures, cost estimates and equipment times needed for effective treatment. The sites selected for eventual treatment are the ones that are expected to generate the most cost-effective reduction in sediment delivery to the drainage network and the mainstem stream channel. Sites which may experience erosion or slope failure, but which are not expected to deliver sediment to a stream channel, are not recommended for treatment to protect fisheries resources. General treatments are cataloged in the computer database during field examination of each site. The specifics of the recommended treatments, as well as costs and logistics (e.g., equipment types, excavation volumes, equipment hours, etc.) are all outlined in this step.

Assessing Treatment Priorities Within Each Inventoried Sub-watershed

As described above, basic treatment priorities and prescriptions are formulated concurrent with the identification, description and mapping of past and potential sources of road-related erosion and sediment yield. Treatment priorities are evaluated on the basis of several factors and conditions associated with each potential erosion site.

1) the expected volume of sediment to be delivered to streams,
2) the potential for future erosion (high, moderate, low),
3) the "urgency" of treating the site (treatment immediacy),
4) the ease and cost of accessing the site for treatments, and
5) recommended treatments, logistics and costs.

The likelihood of erosion (erosion potential) and the volume of sediment expected to enter stream channels from future erosion (sediment delivery) at each site play significant roles in determining its treatment priority. The larger the potential future contribution of sediment to streams, the more important it becomes to closely evaluate its potential for cost-effective treatment. The ***erosion***

potential of a site is a professional evaluation of the likelihood that future erosion will occur. Erosion potential should be evaluated for each site, and expressed as "High," "Moderate" or "Low." Erosion potential is an estimate of the potential for additional erosion, based on local site conditions and field observations. Thus, it is employed as a subjective probability estimate, and not an estimate of how much erosion is likely to occur.

Treatment immediacy (treatment priority) is a professional evaluation of how important it is to quickly perform erosion control or erosion prevention work. It is also defined as "High," "Moderate" or "Low" and represents the severity or urgency of the threat to downstream areas. An evaluation of treatment immediacy considers erosion potential, future erosion and delivery volumes, the value or sensitivity of downstream resources being protected, and treatability, as well as, in some cases, whether or not there is a potential for an extremely large erosion event occurring at the site (larger than field evidence might at first suggest). If mass movement, culvert failure or sediment delivery is imminent, even in an average winter, then treatment may need to be performed as soon as possible and treatment immediacy might be judged "High." ***Treatment immediacy is a summary, professional assessment of a site's need for immediate treatment.*** Generally, sites that are likely to erode or fail in a normal winter, and that are expected to deliver significant quantities of sediment to a stream channel, should be rated as having a high treatment immediacy or priority.

One other factor influencing a site's treatment priority is the difficulty (cost and environmental impact) of reaching the site with the necessary equipment to effectively treat the potential erosion. Many sites found on abandoned or unmaintained roads require brushing and tree removal to provide access to the site(s). Other roads require minor or major rebuilding of washed out stream crossings and/or existing landslides in order to reach potential work sites farther out the alignment. Road reconstruction adds to the overall cost of erosion control work and reduces project cost-effectiveness. Potential work sites with lower cost-effectiveness, in turn, may be of relatively lower priority. However, just because a road is abandoned and/or overgrown with vegetation is not sufficient reason to discount its assessment and potential treatment. Treatments on heavily overgrown, abandoned roads may still be both beneficial and cost-effective.

Evaluating Treatment Cost-Effectiveness

Treatment priorities is developed from the above factors, as well as from the estimated cost-effectiveness of the proposed erosion control or erosion prevention treatment. Cost-effectiveness is determined by dividing the cost ($) of accessing and treating a site, by the volume of sediment prevented from being *delivered* to local stream channels. For example, if it would cost $2000 to access and treat an eroding stream crossing that would have delivered 500 yds^3 (had it been left to erode), the predicted cost-effectiveness would be $\$4/yd^3$ ($2000/500 yds^3).

To be considered for priority treatment a site should typically exhibit: 1) potential for significant (>25-50 yds^3) sediment delivery to a stream channel (with the potential for transport to a fish-bearing stream), 2) a high or moderate treatment immediacy and 3) a predicted cost-effectiveness value of no more than about $\$8/yd^3$. Other criteria may be important in selected watersheds, including domestic water supplies, listed aquatic species or other valuable downstream resources. Treatment cost-effectiveness analysis is often applied to a group of sites (rather than on a single

site-by-site basis) so that only the most cost-effective groups of projects are undertaken. During road decommissioning, groups of sites are usually considered together since there will be only one opportunity to treat potential sediment sources along the road.
Cost-effectiveness can be used as a tool to prioritize potential treatment sites throughout a sub-watershed (Weaver and others, 1981b; Weaver and Sonnevil, 1984). It assures that the greatest benefit is received for the limited funding that is typically available for protection and restoration projects. Sites, or groups of sites, that have a predicted marginal cost-effectiveness value (>$8/yd^3), or are judged to have a lower erosion potential or treatment immediacy, or low sediment delivery rates, are less likely to be treated as a part of the primary watershed protection and "erosion-proofing" program. However, these sites are usually addressed during future road reconstruction (when access is reopened into areas for future management activities), or when heavy equipment is performing routine maintenance or restoration work on nearby, higher priority sites.

Reducing Watershed Sediment Risks through Preventive Treatments and Protective Measures

A variety of treatments are applied to prevent erosion and sediment yield to stream channels from roads and other eroding areas within each sub-watershed. These include erosion-proofing along roads and landings, total or partial road decommissioning, road upgrading and specific treatments along eroding stream banks, gullies and other bare soil areas. Sites which are expected to erode and deliver sediment to streams in the future are the only locations where opportunity exists for meaningful erosion control and erosion prevention work in a watershed. At these locations, a variety of specific treatments are employed to control and prevent future erosion and sediment delivery to stream channels.

Risk reduction through road decommissioning and road upgrading

A critical first-step in the overall risk-reduction process is the development of a watershed transportation analysis and plan. All roads in each planning watershed are considered for either decommissioning or upgrading, depending upon the risk of their impacting the aquatic ecosystem. Not all roads are high risk roads and those that pose a low risk of impacting aquatic habitat in the watershed may not need immediate attention. It is therefore important to rank and prioritize roads in each sub-watershed based on their potential to impact downstream resources, as well as their importance to the overall transportation system and management needs in the watershed.

Decommissioning: Roads which are of low relative priority for decommissioning include those which follow low gradient ridges, roads traversing large benches or low gradient upland slopes, and roads with few or no stream crossings. Roads that are no longer needed for land or resource management may or may not fall into a high risk classification for removal because of where they are located in the watershed. For example, many dead-end spur roads which lead to cable yarding landings high on the hillslope fit into this category of low priority roads for decommissioning. Even though these routes might be relatively easy and inexpensive to permanently close, they are not high priority candidates for immediate decommissioning since their removal will do little to protect the downstream aquatic ecosystem.

These types of low impact seasonal and temporary roads may be identified for closure, but their removal from the transportation system may do little to protect or remove real threats to the aquatic ecosystem. It is important to also identify more substantial, permanent roads for removal if they pose significant threat to the aquatic system. Estimating the future sediment yield and treatment cost-effectiveness of projects along all roads (as described above) will help identify which roads in the watershed are truly the best targets for decommissioning.

Based on potential threats to the aquatic ecosystem, a variety of roads qualify as "best-candidates" for decommissioning. These often include roads built in riparian areas, roads with a high potential risk of sediment production (such as those built on steep inner gorge slopes and those built across unstable or highly erodible soils), roads built in tributary canyons where stream crossings and steep slopes are common, roads which have high maintenance costs and requirements, and abandoned roads. General techniques for decommissioning (described below) are well documented and tested, and costs and procedures for each type of activity have been established (Sonnevil and Weaver, 1981; Weaver and others, 1987a; Weaver and Hagans, 1990; Harr and Nichols, 1993; NPS, 1992).

Upgrading: In most managed watersheds, some roads are typically needed to provide for long term resource management, for administrative access, for fire control and for other purposes. Roads which are best suited for retention need to be identified in the transportation planning process for each sub-watershed. To be protective of fish habitat and the aquatic ecosystem in the watershed, this planning first considers the erosional consequences of road retention, and then the expressed needs for management activities.
Retained roads are those that are expressly needed for management or as a component of the overall transportation network. They are typically, but not exclusively, located on stable terrain, where the risk of fluvial erosion, stream crossing failure, storm damage and mass soil movement (landsliding) is lowest. Each retained road is then upgraded and redesigned as necessary, to make them largely self-maintaining or requiring low levels of maintenance.

A variety of "upgrading" techniques are available to make these stable, well located roads as "storm-proof" as is possible. The goal of road upgrading is to strictly minimize the contributions of fine sediment from roads and ditches to stream channels, as well as to minimize the risk of serious erosion and sediment yield when large magnitude, infrequent storms and floods occur.

Fine sediment contributions from roads, cut banks and ditches in refuge watersheds are minimized by utilizing seasonal closures for hauling and travel, road surfacing, converting ditched insloped roads to outsloped alignments (especially at and near the approaches to stream crossings), adding rolling dips to drain and disperse road surface runoff, and adding rolling dips or ditch relief culverts immediately adjacent stream crossings (to reduce extension of the drainage network and eliminate ditch contributions to sediment yield).

Specific techniques employed to storm-proof forest roads include increasing culvert size to accommodate the 50-year flood discharge (or greater), replacing large culverts with bridges, replacing culverted fills with hardened fords in areas where debris torrenting is common or can be

expected, eliminating the potential for stream diversion at all high risk stream crossings, stabilizing or removing unstable fills and sidecast, and realigning road segments to avoid instabilities and recognized headwater swales where landsliding and debris torrenting is likely to occur.

Types of prescribed heavy equipment erosion prevention treatments

Generic specifications for a variety of preventive watershed treatments have been developed for decommissioning and erosion-proofing (upgrading) roads and landings throughout the Pacific Northwest. Recommended treatments may range from no treatment or simple waterbarring, to full road decommissioning, including the excavation of unstable sidecast materials, road fills, and all stream crossing fills. Each of the treatments prescribed for roads or hillslopes have been well tested, documented and evaluated in similar erosion control and erosion prevention projects on steep forested lands, and have been shown to be effective in significantly reducing sediment yield from managed forest lands (Harr and Nichols, 1993; Sonnevil and Weaver, 1981; Weaver and others, 1981a; Weaver and others, 1987a,b; Weaver and Sonnevil, 1984).

Road upgrading involves a variety of treatments used to make a road more resilient to large storms and flood flows. The most important of these include stream crossing upgrading (especially culvert up sizing and elimination of stream diversion potential), removal of unstable sidecast and fill materials from steep slopes, and the application of drainage techniques to improve dispersion of road surface runoff. Standard road upgrading techniques are well documented and understood (for example, see Pacific Watershed Associates, 1994c).

Road upgrading costs may not differ significantly from those required for road decommissioning. Costs are highly dependent on the frequency and nature of the potential erosion problems along the alignment, the number and size of stream crossings whose drainage structures must be upgraded, the number of bridge installations required, road surface treatments and surfacing requirements, as well as the size (volume) of unstable fills that must be excavated and end hauled to stable spoil disposal locations.

General heavy equipment treatments for road decommissioning are newer and less well published, but the basic techniques have been tested, described and evaluated (Harr and Nichols, 1993; Weaver and others, 1987a; Weaver and Sonnevil, 1984). Decommissioning essentially involves "reverse road construction," except that full topographic obliteration of the road bed is <u>not</u> normally required to accomplish sediment prevention goals. In order to protect the aquatic ecosystem, our goal is to "hydrologically" decommission the road; that is, to minimize the adverse effect of the road on natural hillslope and watershed hydrology. From least intensive to most intensive, decommissioning and upgrading tasks for roads will include at least some of the following tasks[1]:

[1]Many of these and other erosion prevention and erosion control techniques are describe in the accompanying text "Guidelines for Forest Roads and Landings."

1. *Road ripping or decompaction*, in which the surface of the road or landing is "decompacted" or disaggregated using mechanical rippers. This action reduces surface runoff and often dramatically improves revegetation.
2. *Rolling dip installation/construction (critical dip),* involves dipping the roadbed at stream crossings on maintained roads where the potential for stream diversion is high, thereby assuring that when culverts plug, stream flow will be directed over the road prism and back into the natural stream channel, rather than down the road bed. Rolling dips are also installed along roads to drain the road surface and disperse excess surface runoff.
3. *Waterbars and cross-road drains* are installed at 50, 75, or 100-foot intervals, or as necessary at springs and seeps, to disperse road surface runoff, especially on roads that are to be permanently or temporarily decommissioned. Cross-road drains are large ditches or trenches excavated across a road or landing surface to provide drainage and to prevent the collection of concentrated runoff on the former road bed. Waterbars are also installed on season roads that are closed during the wet season.
4. *Installing or cleaning culverts,* includes adding new or larger culverts where they are needed, or cleaning the inlets or outlets of partially plugged culverts on maintained roads. Correct installation procedures are briefly described in the accompanying text “Guidelines for Forest Roads and Landings.”
5. *In-place stream crossing excavation (IPRX)* is a decommissioning treatment that is employed at locations where roads or landings were built across stream channels. The fill (including the culvert) is completely excavated and the original stream bed and side slopes are exhumed. Excavated spoil is stored at nearby stable locations where it will not erode, sometimes being pushed several hundred feet from the crossing by tractor(s). A stream crossing excavation typically involves more than simply removing the culvert, as the underlying and adjacent fill material must also be removed and stabilized.
6. *Exported stream crossing excavation (ERX)* is a decommissioning treatment where stream crossing fill material is excavated and spoil is hauled off-site for storage. Spoil is moved farther up- or down-road from the crossing, due to the limited amount of stable storage locations at the excavation site. This treatment frequently requires dump trucks to endhaul spoil material to the off-site location.
7. *In-place outsloping (IPOS)* ("pulling the sidecast") calls for excavation of unstable or potentially unstable sidecast material along the outside edge of a road prism or landing, and replacement of the spoil on the roadbed against the corresponding, adjacent cutbank, or within several hundred feet of the site. Placement of the spoil material against the cutbank usually blocks access to the road and is used in road decommissioning. In road upgrading, the excavated material can be used to build up the road bed and convert an insloped, ditched road to an outsloped road.
8. *Exported outsloping (EOS)* is comparable to in-place outsloping, except spoil material is moved off-site to a permanent, stable storage location. Where the road prism is very narrow, where there are springs along the road cutbank or where continued use of the road is anticipated, spoil material is typically not placed against the cutbank and material is end hauled to a spoil disposal site. This treatment frequently requires dump trucks to endhaul spoil material. This t treatment removes all or part of the roadbed.

Only in relatively few instances does road decommissioning have to include full recontouring of the original road bed. Typically, potential problem areas along a road are isolated to a few locations (perhaps 10% to 20% of the road network to be decommissioned) where stream crossings need to be excavated, unstable landing and road sidecast needs to be removed before it fails, or roads cross potentially unstable terrain and the entire prism needs to be removed. Most of the remaining road surface simply needs permanently improved surface drainage, using decompaction, road drains and/or partial outsloping.

Successfully decommissioning most roads will cost a fraction of complete or total topographic road obliteration, and can be significantly less expensive than road upgrading. Costs are highly dependent on the frequency and nature of the potential erosion problems along the alignment. **Table** 1 lists a number of treatments and their typical applications.

Table 1.
Sample techniques and applications for decommissioning forest roads

Treatment	Typical use or application
Ripping or decompaction	improve infiltration; decrease runoff; assist revegetation
Construction of rolling dips and cross-road drains	drain springs; drain insloped roads; drain landings
Partial outsloping (local spoil site; fill against the cutbank)	remove minor unstable fills; disperse cutbank seeps and runoff
Complete outsloping (local spoil site; fill against the cutbank)	used for removing unstable fill material where nearby cutbank is dry and stable
Exported outsloping (fill pushed away and stored down-road)	used for removing unstable road fills where cut banks have springs and cannot be buried
Landing excavations (with local spoil storage)	used to remove unstable material around landing perimeter
Stream crossing excavations (with local spoil storage)	complete removal of stream crossing fills (not just culvert removal)
Truck endhauling (dump truck)	hauling excavated spoil to stable, permanent storage location where it will not discharge to a stream

Labor intensive erosion control and revegetation treatments

Hand labor is typically used for both revegetation and erosion control work at sites disturbed by heavy equipment, at sites where drainage structures need repair or upgrading, and where hand labor is needed to assist in excavation work. Hand labor is also needed on sections of road that are recommended for upgrading. Labor work at drainage structures include such preventive tasks as adding culvert downspouts and trash racks, adding extensions to culverts, cleaning culvert inlets, cleaning debris out of the channel above a culvert inlet, and assisting in culvert installation or replacement.

Labor intensive erosion control treatments are often needed on sites where heavy equipment has been used to perform road decommissioning. Their use is primarily confined to those measures required to stabilize and revegetate soils exposed by heavy equipment operations. Only the most effective and cost-effective labor techniques should be prescribed. These include mulching, seeding and planting. In general, heavy equipment will perform most of the significant erosion prevention and erosion control work in drainage basins and along road networks.

Control of chronic sediment yield from roads and roadside ditches

Road cutbanks and road ditches are thought to deliver relatively significant volumes of fine sediment to some watersheds in the Pacific Northwest (Reid, 1981) and they have been found to significantly affect watershed hydrology (Wemple, 1994). Relatively simple treatments will also be performed to upgrade P.L. road drainage systems to significantly reduce or largely eliminate these watershed effects. Fine sediment can usually be prevented from entering culverted stream crossings by installing ditch relief culverts or rolling dips just up-road from stream crossings, or by outsloping roads in the immediate vicinity of stream crossings (Pacific Watershed Associates, 1994a). Such treatments also reduce the hydrologic impacts of roads (e.g., increased peak flows and timing of peak flows) on watershed function.

Reducing watershed risks through other land management measures

Physical treatment of the erosion control and erosion prevention work sites is a useful and necessary step in watershed stabilization. It is one of two complementary methods for "erosion-proofing" and "protecting" a watershed from future impacts. The second and perhaps the most cost-effective tool for minimizing future erosion and sediment delivery to fish-bearing streams is the use of preventive land use practices and protection measures which limit watershed disturbances.

Throughout field mapping of active and abandoned roads, timber harvest sites, rock pits and grazing areas throughout each sub-watershed, observations are kept on the effect of past and current land use practices on erosion and sediment delivery to stream channels. Certain combinations of land use practices and site variables (soils, slope gradient, bedrock geology, slope position, etc) are may be documented to contribute to, or influence, the magnitude or location of watershed erosion. Based on field observations and watershed assessment and inventory data, current and future land use practices can then be modified in that watershed to help provide “passive” protection to downstream aquatic resources, especially from impacts which occur during infrequent floods.

Practical protection measures related to road networks and timber harvesting are developed to address issues such as improved road location and design standards, operations (including timber harvesting) on steep inner gorge slopes or other suspect geomorphic locations, road construction and drainage practices, stream crossings, road maintenance practices, gullying and stream bank erosion and road decommissioning. For grazed lands, grazing allocations, riparian planting and fencing, localized exclosures, seasonal restrictions and other “passive” measures can be employed to lessen the potential for sediment-related impacts to stream channels.

As with other forms of watershed conservation practices, erosion prevention is usually far more cost-effective than trying to control erosion once it has begun. Most of the recommendations for land use activities that stem from a watershed assessment and inventory focus on prevention.

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ATTACHMENT
Explanation/Instruction for Road Inventory Data Form

The following field inventory dataforms are examples of the types of data, related to storm-proofing watersheds, currently being collected on Pacific Lumber lands. The data collection process is iterative. As we gain new knowledge about ecosystem processes, the specific questions on the data form will change to reflect our increased understanding.

The Field Inventory Data Form (Figure 2) was developed to assist in the assessment of past and potential future erosion problems, including their nature, cause, magnitude and solution. It is used to identify and classify erosion problems, to prioritize potential work sites, and to prescribe specific watershed treatments aimed at protecting stream channels and fish habitat.

Use of this work sheet is intended to provide a standardized and comparable analysis of observed features throughout a watershed. Using this form, field personnel can measure, describe and interpret landforms and erosional problems in a consistent and uniform manner. In addition, data is most useful if it is collected in a computerized database format that will allow for inventory information to be rapidly searched, analyzed and used to prepare a work plan for implementation.

Based on field observations and interpretive remarks provided on this form, and developed through additional site inspections, land managers will be provided with a prioritized listing of the most critical, on-going and potential sediment sources within each basin.

The following text is provided to help explain the intent and meaning of many of the questions, and to suggest the format of possible answers, contained on the Inventory Data Form (Figure 2). Not all questions are applicable for each site identified in the field. Only those questions which are applicable for a site should be answered, and only the type of answer allowed (e.g., Yes or No,... or a number) should be given. Comments can be made in the comment sections. Figure 3 has been included to illustrate the types of data collected along selected stream channels during watershed assessment efforts. The questions are largely self explanatory, therefore no instructions for use of the landslide form have been provided at this time.

1. Site Number: The identification name or number given this specific site. Each site should have a unique ID number for future reference which is shown on an aerial photo mylar overlay. The number is also used to identify each site in database searches.
2. Mileage: For each site that could be reached by a vehicle, a "mileage" is logged on the photo overlay map and on the computerized data sheet. Mileages are typically given from the start of the road for each site that could be reached by vehicle. If the road was not driveable, the word "WALK" is used instead of a mileage. The length of walking-roads is then determined from digitizing maps or aerial photographs.
3. Photo: The flight line and frame of the air photos used for mapping. Original field mapping information is contained on an acetate overlay for each of the aerial photos covering the assessment area.
4. Sketch?: Have you made a sketch of the site (on the back of the data form)?

5. Road Name: The name of the road which the site is located on, or nearest to. Many roads have posted names, such as the #500 Road. Other roads will be un-named and you will have to develop a logical numbering system.
6. Maintained (Y,N): Is the road currently being maintained? Is there evidence of maintenance activities having been performed recently? (Y,N)
7. Abandoned (Y,N): Answered "Yes," if the road is abandoned or blocked, and unmaintained. The road may still be driveable, but it is classified as abandoned if there is no obvious maintenance to the culverts, the ditches are not cleaned, and vegetation is overgrowing the roadbed. Spur roads are also considered abandoned if they are completely and permanently blocked at their beginning. Gated roads are not necessarily considered abandoned, but they may be. If the road is not "abandoned," then it is considered "maintained."
8. Driveable (Y,N): Could you drive on the road, or are there obstructions, washouts or vegetation that make it impossible?
9. Inspector(s): Use the names or initials of the inventory crew.
10. Date (mapped): The date the field mapping for this site was carried out.
11. Watershed: The name of the watershed (from the map or from the landowner).
12. Year Built: This is the first year the road showed up on aerial photographs. This is not likely the year it was constructed. The construction history for roads in the assessment area is obtained from maps and aerial photographs.
13. Treat (Y,N): The answer to this question represents our final recommendation as to whether on not this site should be treated. It is answered: "Y" if the site should be treated, "Y?": if the site should be treated if equipment is at or near the site doing other work and "N" if this site is not recommended for treatment.
14. Sediment Yield (Y,N): Will this site yield sediment to a stream channel if it is left untreated? If this question is answered “no” then you probably don’t need to fill out a data sheet (it’s not a site).
15. Upgrade?: Are the recommended measures aimed at upgrading and “storm-proofing” this road?
16. Decommission?: Has this road been “decommissioned?” or is it being recommended for decommissioning?
17. Problem Type (circle): Circle the appropriate type(s) of problems at each locality. (Note: gullies are new channels that have a cross sectional area over 1 ft^2 (1'x1'). Gullies are caused by concentrated surface runoff (often below culvert outfalls, on skid trails or on large bare areas such as landslide scars) or by stream diversions. Anything smaller is considered a rill and lumped with surface erosion processes. Streambank erosion is often natural and unavoidable but can be accelerated by the build-up of bed deposits in the channel, deflected stream flow caused by landslides or debris in the channel, or by increases in discharge.)
18. Road Fill Failure (Y,N): This just involves the outside edge of the road prism, where loose material was pushed over the side during road construction. These failures can show up many years after construction.
19. Landing Fill Failure (Y,N): This just involves the outside edge of the log landing, where loose material was pushed over the side during landing construction. These failures can show up many years after construction.

20. Deep Seated Slide (Y,N): These features usually cover fairly large areas with multiple scarp systems running through natural slopes and/or across roads and skid trails. Characterized by emerging groundwater, leaning trees, active and inactive scarp systems, and episodic, seasonal movement from several feet to several hundred feet annually. Some may not move annually. Most deep seated landslides are difficult and expensive to control. They usually involve much more than just the road fill.
21. Cutbank slide (Y,N): This is a landslide that is confined to the cutbank on the inside of the road. Usually, these landslides just dump material on the road bed and none of it gets into the stream channels. Some of the bigger slides can go right over the road and down slope into a channel. Cutbank slides are usually just maintenance problems (not sediment yield problems).
22. Already failed (Y,N): Landslides which have already failed are generally inactive features that have partially or largely revegetated and show no significant signs of pending erosion or sediment delivery. Gullies will often have armor lag deposits in the channel bed. Landslides may be inactive even though vegetation is still sparse and it still looks bad.
23. Potential failure (Y,N): Features which are assigned this category are thought to be potentially ready and waiting to fail. They may be currently inactive (showing no signs of movement in the last several years), but the scarps and other indicators suggest that during an especially large storm the instability could become active and fail or move downslope. It may also be part of slide that already failed, but there is still a chunk ready to go.
24. Dist. to stream (ft): How far is it from this landslide site from the nearest stream (where sediment would be delivered), in feet?
25. Slope (%): What is the slope of the hillside below the site, in percent? This is the slope of the natural ground below the base of the fill slope, not the slope of the road fill looking from the outside edge of the road. You will likely have to go down to the foot of the fillslope to take a good measurement with your clinometer.
26. Stream Crossing Type: Stream crossings are locations where ephemeral, intermittent or perennial streams cross a road. The crossing may be a culverted crossing, a bridge, a Humboldt log crossing, or a fill crossing that never had any drainage structure installed. Mark "Y" or circle the applicable answer.
27. Diameter (CMP)(in inches): This is the culvert diameter, in inches. Typical choices include 12, 18, 24, 30, 36, 42, 48, 52, 60, 72. Measure each culvert with a measuring tape because it is easy to be fooled and guess incorrectly.
28. Pipe condition (O,C,R,P): This question requires three answers - the Inlet, the Outlet and the Bottom of the culvert pipe. O = OK; C = Crushed; R = Rusted (severe, to the point of having holes in the bottom); P = Plugged (anything over about 20% blocked should be marked "plugged").
29. Headwall height (inches): Headwall height measurements are only made on stream crossings with culverts. Measure the vertical height from the bottom of the culvert inlet to the lowest point in the stream crossing fill where the water would begin to flow out of the crossing and down the ditch, or over the fill on onto the road. Some headwall height measurements will be made to the low point on the inboard edge of the road and others will be made to the ditch. You have to figure out where the low point is and where water would flow if the culvert were to plug.

30. CMP slope (%): What is the average slope of the culvert? This measurement can be taken by looking up the culvert from the outlet, or down the culvert from the inlet. Use a clinometer. If the culvert is straight, you can place you clipboard in the culvert inlet, put your clinometer on you clipboard and read out the slope gradient.
31. Stream Class (1, 2, 3): These are the stream classed used by Fish and Game and the Department of Forestry. Basically, Class I are fish bearing at some time of the year, Class 3 move sediment but don't provide any habitat to bugs or amphibians. Class 2 are the rest (have bugs and/or amphibian habitat at some time of the year.
32. Ditch/rd length (ft): The length of road and ditch which contributes surface runoff (and fine road sediment) to the stream crossing.
33. % washed out (%): if the crossing is eroding, how much of it has gone? Is it 10% washed out or is it 50% washed out. If it is completely washed out you put "100." Culverted stream crossings can wash out by having stream flow over the fill, by having extreme culvert outlet erosion or by having a Humboldt log crossing develop sink-holes and subsurface gully erosion.
34. ? (Y,N): Does the crossing have a high diversion potential? (Y or N) That is, if the culvert plugged, would flood waters spill over the road and back into the stream channel (No D.P.) or would the water flow down the road or ditch (High D.P.). All stream crossings (where roads cross over stream channels) have either no DP or a high DP. There are no other choices. If the crossing has No D.P., overflow might cause the fill to be washed out, but the streamflow would not be diverted out of its channel. If the crossing has a High D.P., the fill crossing at the point of diversion would not wash out but a gully would form down the road, in the ditch and/or where the water left the road and crossed the slope.
35. Diverted (Y,N): Is the stream currently diverted down the road?
36. Plug potential (H,M,L): This is the estimated potential for this culvert (or Humboldt log crossing) to plug with sediment or woody debris (High, Moderate or Low). It has a plug and high failure potential if the capacity is too small, or if the culvert could be easily plugged. This is an **estimate** of how likely the culvert is to plug in the next big storm. The amount of mobile organic debris and sediment being transported in the channel and whether or not an adequate trash rack is in place (some crossings work fine without a trash rack because little debris moves in the channel during storms) are considered.
37. Channel gradient (%): The slope of the natural channel upstream from the stream crossing, in percent. Do not measure channel gradient in the flat reach influenced by the stream crossing and culvert inlet.
38. Channel dimensions (W, D): The dimensions of the expected flood flow (peak) natural channel width and depth, measured in feet, upstream from the crossing in a section of stream un-affected by the stream crossing.
39. Sed Transport (H,M,L): This is the relative capability of the stream to transport sediment (and thereby move sediment and debris down to the culvert inlet) (answered: High, Moderate or Low). This is a subjective and relative observation that needs to be "calibrated" in the field.
40. Erosion Potential (H,M,L): The estimated potential for additional erosion is a judgement call, based on observations already taken, as to the potential for additional, significant erosion at this site. This is a probability estimate, not an estimate of how much erosion is likely to occur. The answer is either **H**igh, **M**oderate or **L**ow.

41. Past Erosion (yds): The volume of past erosion (yds^3) at the site is recorded. The volume is typically derived from field measurements. Width, depth and length measurements can be recorded here also. If the feature is complex, several different measurements may be given to account for the entire feature.
42. Delivery (%): This is an estimate of the percent of the past eroded material that was actually delivered to the stream channel system.
43. Future Erosion ($yds^{3)}$: This is the estimated volume of future erosion. It is determined by taking quantitative planimetric measurements in the field and calculating the size and volume of potential erosion that would be generated. This question calls for an estimate, but the estimate is based on field observations and measurements. For existing gullies, potential and existing landslides and potential stream crossing washouts, it is possible to estimate the volume of future erosion that is likely to occur.

    Volumes are easiest to estimate for potential stream crossing washouts, because the fills placed in the channels when roads are built are fairly regular in shape and you can assume most of the fill would eventually be lost if the culvert plugged and the crossing washed out by fluvial erosion.

    Next, over steepened landings generate limited volumes of sediment when they fail by debris sliding, and these quantities can be estimated fairly easily.

    Existing, enlarging gullies lengthen, widen and deepen until they become stable and the final dimensions (hence volumes of future erosion) may be estimated. Indeed, many existing gullies that were formed during major storm events and still look raw may already be largely stable. Most sediment to be eroded from these features may well be limited to gradual bank retreat and collapse.

    Debris slides (landslides) generated from steep headwater swale areas (usually where they are crossed by roads) are limited in size at the point of origination. However, debris slides generated at these sites often grow much larger as they move down the steep channels and scour debris from the channel bed. This makes their final volumes sometimes much larger than that estimated at the initiation site itself. Use your best judgement and base your volume predictions for such features on occurrences that have been documented or observed in your area. If your estimate includes additions of material scoured from channels and downslope areas, via these debris torrent mechanisms, make sure you differentiate the two sources on the check sheet.

    The future volumetric yield of large translational landslides can be difficult to estimate largely because they move episodically, they move at unpredictable rates and they occasionally become self-stabilized after moving for a period of time. Such slides are typically bounded by scarps or other natural features that place an upper bound on the amount of material that is likely (or possible) to move downslope and into a stream channel. However, this is an upper limit and not a reasonable estimate of the expected future volume. Instead, an estimate is made of what portion of the mass is likely to move downslope before the feature eventually stabilizes. Potential volumetric contributions from debris slides and other "fast" mass movements can be predicted much more easily than yields from episodically active translational landslides.

44. Future Delivery (%): Will future eroded sediment enter a stream channel? If any of the future eroded sediment will enter a stream channel and could eventually be washed to downstream areas, then there will be delivery. If all the eroded sediment will be stored on the slope and never move into the stream system then there will be no delivery. This is an estimate of how much sediment (expresses as a % of the volume of expected erosion) that is likely to be delivered to the stream channel.
45. (WxLxD): Measurements of the potential erosion feature, expressed as average Width X Length x Depth. If the feature is complex, several different measurements may be given to account for the entire feature. These measurements describe the planimetric assumption used by field personnel to determine future erosion volumes.
46. Comment on problem(s): The summary comments for each site generally describe the nature of the erosion problem and important site characteristics. The summary comments section is here to help the reader quickly gain a feel for the site without having to read all the detailed questions that follow.
47. Treatment Immediacy (H,M,L): The subjective answer to this question lets you decide if the work needs to get done right now! or later. Is the feature falling apart and going to change dramatically this coming winter? Does erosion at this site seriously threaten important downslope or downstream resources (eg spawning or rearing areas)? Answer "High", "Moderate" or "Low" (no big rush, but erosional problems or potential erosion source should be corrected in the future). This is question that field personnel summarized how critical it is to perform erosion control work at this site. This answer is based on the severity of the potential erosion, its volume, its predicted activity level and the sensitivity of the resources at risk.
48. Complexity (H,M,L): A subjective estimate of the difficulty of performing the recommended treatment. For example, a simple stream crossing excavation or the excavation of a small unstable fill along the outboard edge of the road would usually be categorized as LOW complexity. On the other hand, a 1,000 yd^3 excavation of a Humboldt log crossing which will require construction of a lower access road and dump truck endhauling may be classified as a HIGH complexity site. It is best to explain your thoughts in the comment section at the bottom of the data sheet.
49. Mulch area (ft^2): This is the expected area that will be bared by heavy equipment operations. This area may need mulching and seeding to control erosion after operations are complete. Many sites located away from stream channels will not need these treatments. Only if bare soil could erode and be delivered to a stream channel is there a need to mulch and seed.
50. Possible Treatments, "Y" is placed next to recommended treatments. “Excavate soil” is reserved for excavations where the soil will be permanently removed from the site (thus, replacing or installing a culvert is not marked “excavate soil” because all the dirt is placed back in the hole - if some dirt is permanently removed from the work site, then mark “excavate soil).
51. Total volume excavated (yds^3): This is the total volume of material which must be excavated from the unstable fillslopes or stream crossings at this site. This volume is used to help predict costs and equipment times needed to perform the excavation work. In addition, it is used to help determine whether endhauling will be necessary to dispose of spoil from the site. Questions related to the excavation of fill crossings on abandoned roads: This is actually the

estimated volume of material that will have to be excavated from the stream crossing site to prevent future erosion and sediment delivery. In many cases, because the stream banks must be sloped back to a stable gradient, slightly more sediment will have to be excavated from the crossing than would eventually fail or be washed away by fluvial erosion. The computational field procedure for estimating excavation volumes are not described here.

52. Volume put back in (yds^3): This is the volume of material that is to be put back in the "hole," as in a new culvert installation or a culvert replacement.
53. Volume removed (yds^3): This is the volume of excavated material that will not be put back into the excavation "hole." A good example would be the excavation of unstable sidecast material - zero would be "put back in" and all of it would be "removed." Express these numbers in cubic yards.
54. Volume stockpiled (yds^3): How much of the excavated spoil can you pile locally (without using dump trucks).
55. Volume endhauled (yds^3): From measurements in the field, the available storage volume is calculated and compared to the total excavated volume to determine the need for endhauling equipment. If local storage is insufficient, additional storage sites will have to be found in nearby areas along the road. Endhauling requires dump trucks.
56. Exc. Production rate (yds^3/hr): State the production rate (excavation rate) your have used for this site to calculate the needed equipment hours. Use the comment section at the bottom of the page to itemize how many hours of each piece of equipment are assigned for each task and sub-task. See the "cheat-sheet" for some general guidance in estimating equipment production rates for various tasks).
57. Equipment hours: If a piece of equipment is to perform several different tasks or subtasks, then list the individual times that go together to add up to total equipment time for each piece of equipment.

    Excavator (hrs) - estimated hours of excavator time needed for direct excavation at the work site. This estimate does not include time for travelling or other miscellaneous tasks.

    Dozer (crawler tractor) (hrs) - estimated hours of tractor time needed for direct excavation at the work site. This estimate does not include time for travelling or other miscellaneous tasks.

    Dump trucks (hrs) - estimated hours of dump truck time needed for endhauling excess spoil to stable storage locations.

    Grader (hrs) - estimated hours of road grader time needed for direct excavation and road work at the work site. This estimate does not include time for travelling or other miscellaneous tasks.

    Loader (hrs) - estimated hours of loader time needed for direct excavation at the work site. This estimate does not include time for travelling or other miscellaneous tasks.

    Backhoe (hrs) - estimated hours of backhoe time needed for direct excavation at the work site. This estimate does not include time for travelling or other miscellaneous tasks.

    Labor (hrs) - estimated hours of laborers needed to perform such tasks as culvert installation, culvert cleaning, etc.

    Other - This category is reserved for any other tasks or equipment not listed above.

58. Comment on treatment: Included in this comment section are estimated equipment hours needed for backhoes, dump trucks, etc. In addition, details for equipment or labor treatments and logistics may be outlined in this comment. You should strive to fill this comment with useful information.

ATTACHMENT 4
CHANGED AND UNFORESEEN CIRCUMSTANCES

(a) Attachment 4: Changed and Unforeseen Circumstances

I. THE "NO SURPRISES RULE"

The No Surprises rule generally provides that, as long as the HCP is being properly implemented, the federal government will not require additional land or money from the permittee in the event of unforeseen circumstances, and that any additional measures to mitigate reasonably foreseeable changed circumstances will be limited to those changed circumstances specifically identified in the HCP (and only to the extent of the mitigation specified in the Plan).

The Rule has the following two major components:

(1) Changed Circumstances: if additional conservation and mitigation measures are deemed necessary to respond to changes in circumstances that were provided for in the HCP, the landowner will be expected to implement the measures specified in the HCP, but only those measures and no others; and

(2) Unforeseen Circumstances: the Services will not require the commitment of additional land, water or financial compensation or additional restrictions on the use of land, water or other natural resources, even upon a finding of unforeseen circumstances, unless the landowner consents. Upon a finding of unforeseen circumstances, the Services are limited to modifications within conserved habitat areas and the HCP's operating conservation program. Additional conservation and mitigation measures will not involve the commitment of additional land, water or financial compensation or additional restrictions on the use of land, water or other natural resources.

Changed circumstances are those changes in circumstances affecting a species or geographic area covered by an HCP that can reasonably be anticipated by the landowner and the Services at the time of preparation of the Plan and that can be planned for.

Unforeseen circumstances are those changes in circumstances which are not "changed circumstances," i.e., those changes in circumstances affecting a species or geographic area covered by an HCP that could not reasonably have been anticipated by the landowner and the Services at the time of the HCP development and that result in a substantial and adverse change in the status of a species covered by the HCP. The Services bear the burden of demonstrating that unforeseen circumstances exist, using the best available scientific and commercial data available, and considering certain specific factors.

Consistent with the Rule and long-established agency practice, the HCP Implementation Agreement includes provisions restricting the authority of the agencies to require additional mitigation measures from PALCO to provide for the conservation of the Covered Species.

II. DYNAMICS OF COASTAL PACIFIC FORESTS - FIRE, WIND, FLOOD, LANDSLIDE AND EARTHQUAKE CHANGED CIRCUMSTANCES AND UNFORESEEN CIRCUMSTANCES

INTRODUCTION

The forest ecosystems on PALCO's lands present the context within which this plan is prepared. These ecosystems are by no means static; they are dynamic, regularly impacted by various physical processes that shape and reshape the habitat for affected resident, transient and migratory species which occupy those lands during some or all of their natural history. Indeed, the many aquatic, avian and terrestrial species for whose conservation this plan is crafted evolved in close association with this ever-changing mosaic of biological elements. However, circumstances may be much changed today on industrial timberland from original natural conditions, and the rate at which changes now occur from land management may be accelerated over evolutionary processes.

Briefly, the physical processes which affect the biodiversity and landscape ecology of PALCO lands are usually of low intensity, and they are generally quite confined in geographic extent and significance of impact. Nonetheless, historically in some forest environments, physical processes have on rare occasions been of "catastrophic" intensity, from the standpoint of impact to individual plants and animals, and these can affect large areas of the forested landscape. The very term "catastrophe" means a sudden, unexpected disaster, for which there can be no preparation. The term, intensity, periodicity and scale of such "catastrophic" events remain stochastic, impossible to predict, and they are inevitably differentially applied across the landscape.

That physical processes *can* significantly alter forest habitat has been a substantive consideration in the development of this Plan. Below, we briefly summarize why we believe such possibilities are sufficiently remote as to require no further or additional land management restrictions beyond that described below as the appropriate response or range of responses to a particular changed circumstance.

The human perspective of processes acting on the physical and biological environment is generally narrow and limited, given the temporal and spatial context of the occurrence and frequency of such events. But it is important to understand the dynamics of the relationship between the physical processes at work in the forest environment and their effects upon forest habitat. This understanding is enhanced by observing both the present relationship and the physical record left in location geology, tree rings, soil profiles, relic tree distributions, etc.

The marbled murrelet, the coho salmon, northern spotted owl, and other forest and aquatic species embraced within this habitat conservation plan were no doubt present in North America prior to the

arrival of the first Native Americans, and their populations were doubtless affected by changing climatic conditions, just as were the first Native Americans in North America (see Hoffecker, et al. 1993 for perspective). Indeed, the coastal areas of southern Alaska and British Columbia (and much of Washington), where marbled murrelets are now most abundant, were under ice, and forests were absent, during the last glacial maxima (see interesting presentation in Pielou 1991). Obviously, marbled murrelets and other forest related species subsequently successfully colonized the forests of these areas, and since then, they have persisted in the presence of forest processes, including the effects of fire and wind, flood, earthquake and landslides, on forest ecosystems and structure.

Presented here is a short review of literature on fires, windstorms, and other physical processes, and their effects on the coastal forests of the Pacific Northwest. In addition, our observations of forest structure relative to these processes on the lands of PL are presented. This review is not exhaustive of the primary technical literature, although such references are cited, but in the main relies on technical review articles. Unfortunately, the literature on this subject is derived from few locations in the region, and summary statements are necessarily general in nature. The vast environmental heterogeneity of the forests of the region compounds the difficulty encountered in any attempt to predict the likelihood or scope of these kinds of events, or the potential for the effects and impacts they may pose.

The relationship between fire, flood and other physical processes in the structure and composition of forest communities has been appreciated for a considerable period of time. In general, there is a growing awareness of the role and importance of fire, and to a lesser degree windstorms and other more localized disturbance agents, in the maintenance of animal communities and habitat within the North American landscape, including the Pacific Northwest coastal forests (see e.g., Franklin and Dyrness 1973; Brown 1985; Henderson, et al. 1989; Morrison & Swanson 1990; Agee 1991).

It is generally appreciated that fire events, especially catastrophic events, effect immediate changes in vegetation structure and contained animal communities (see e.g., Quinn 1990 and contained references). Such changes are also known for forest areas (Huff, et al. 1985). There is little doubt that large, catastrophic fires, and windstorms and other significant environmental events have, just as did the eruption of Mt. Saint Helens, the potential to impact members of local animal communities through changes in supporting habitats. However, it is also quite apparent that the populations of many species have survived in the presence of periodic fires, floods, earthquakes and windstorms within their occupied ranges and habitats, as they occur in present forests. More likely than not most species will continue to survive with populations of sufficient size, distribution and connectivity to successfully avoid concerns for genetic isolation and stochastic demographic events.

A. THE ROLE AND EFFECTS OF FIRE

Fire can be a significant agent in determining forest structure in the Pacific Northwest but its effects, intensity, and frequency vary considerably (Agee and Edmonds 1992). Although it is possible to generalize that fire is an important element in forest ecology, it is not possible to specify the impacts of fire on any given area. This is so because invariably, fires are not uniformly distributed through time (Morrison and Swanson 1990), the areas affected often differ markedly (Henderson, et al. 1989), and the intensity and scale vary considerably (Henderson, et al. 1989; Morrison and Swanson 1990). Regional examples of the role of fire over the past several hundred to few thousand years demonstrate this variability.

The Olympic Peninsula of Washington, the site of the Olympic National Park and Olympic National Forest, is well known for the large variation in rainfall and plant communities. The Olympic Peninsula also provides important habitat for a variety of at-risk fish and wildlife species. Much of the forest of the Olympic Peninsula is theoretically within the known daily flight range of nesting Marbled Murrelets, for example. Generally, the western lowlands of the Olympic Peninsula, an area of significant rainfall, are within the Sitka Spruce Zone, while the eastern and northeastern lowlands, areas of lower rainfall, are within the Western Hemlock Zone (Franklin and Dyrness 1973: Henderson et al. 1989).

Fire is relatively unimportant as a process in the Sitka Spruce forest, where a fire return rate (i.e., average interval between fires) of 900 years is observed. There were few fires in the last 700 years and these were generally in dryer southern aspect areas, and they were relatively small in area (Huff et al. 1985). In contrast, in the Western Hemlock forest fire is a significant process in the ecosystem; most areas in this forest type have burned several times in the last 700 years. Yet, even in this area, the fire return rate, for large intense fires, is 234 years. The last catastrophic fire in this area of landscape proportions only burned about 2,700 acres (Henderson et al. 1989).

The relatively infrequent occurrence of significant fire events in the wet lowland Sitka Spruce Zone on the Olympic Peninsula (Henderson et al. 1989) is likely representative of the role of fire in this zone from southern Alaska to northern California, where it blends into the coast redwood forest, a special type of the Sitka Spruce Zone (Franklin and Dyrness 1973). This is a community of long-living tree species where reproduction may be limited to openings in the forest from windthrow or other mortality of trees. As the cited authors note, in the Olympic Rain Forest reproduction is from downed logs and seedlings, and there are few places where fire has allowed Douglas-fir to establish.

Along the Pacific Coast in Washington and Oregon, the Western Hemlock Zone lies inland of the Sitka Spruce Zone and is usually drier than the last. As shown, fires are more common and more intense within the Western Hemlock Zone. However, within this zone, there is a gradient in the intensity, scale, and frequency of fires (Agee and Edmonds 1992), and perhaps all of this zone has burned over the past several hundred years. Douglas-fir is often dominant or the sole dominant in rural stands and Douglas-fir dominates large forest areas (Franklin and Dyrness 1973). Along

much of the Oregon coast, fire intervals vary from 90 to 150 years, to 500 years inland at the crest of the coast range. Yet, there are many examples of 400 to 600 year old old-growth stands.

Fire plays a role in determining the structure of coast redwood forests. Indeed, Franklin and Dyrness (1973) state "Almost all the large [coast redwood trees] bear massive scars suggesting it may be a seral species dependent upon fire for reproduction." Others (Agee and Edmonds 1992) have noted that south of Eureka fires of moderate intensity were fairly frequent in occurrence. They report fire intervals of 50 to 500 years in the coast redwood region. Other authors have reported low intensity fires in the redwood zone may have return intervals as low as 12-20 years. However, stand replacing fires are apparently very rare events.

Site-specific susceptibilities to fire are evident in the redwood forests of Northern California. For example, compared to alluvial flood plain areas, fire is likely to be more common in areas of topographic relief within the coast redwood forests (e.g., ridgetops). On PALCO lands, although there are specific site or stand peculiarities, fire scars are commonly evidenced on large coast redwoods and Douglas-firs, indicating both the widespread occurrence of fire and the particular resistance of these mature trees to consumption by fire. However, in some old-growth stands on PALCO's lands distinct age classes are evident. These observations suggest the presence of a relatively stable old-growth coast redwood forest subject to fires of moderate intensity, but occurring on a scale of centuries. Again, the implication is that fire, although present, is not leading to stand destruction and replacement except on a scale of centuries.

In light of this analysis, it is not reasonably foreseeable that stand replacing fires will occur on PALCO's lands during the life of this conservation plan. Thus it is unnecessary to provide for new, different or additional mitigation or conservation, including management restrictions or reserve configurations based on any speculation that such effects could occur.

Fire Changed Circumstances

Wildfires (including, but not limited to, those originating from timber operations and prescribed burning) that cover 20 percent or more of a planning watershed but are 5000 total acres or less constitute Changed Circumstances.

In order to mitigate the impact of such changed circumstance fires on aquatic species, PALCO, in cooperation and consultation with the Wildlife Agencies, will conduct an expedited watershed analysis on the hydrologic unit impacted by any changed circumstance fire.

The analysis will be commenced as soon as the requisite personnel from PALCO and the Wildlife Agencies required for the analysis can be made available. If watershed analysis has been performed previously for such hydrologic unit , then the affected area will be revisited. If the area has not been previously analyzed prior to the changed circumstance, then it will be made a priority for analysis.

If multiple fire changed circumstances sufficiently close to each other in time such that the response will be significantly delayed due to lack of available personnel, PALCO will confer with the Wildlife Agencies in order to prioritize the analyses which need to conducted as a result of the changed circumstance.

The outcome of watershed analysis will be the development of appropriate measures to minimize, to the extent practicable, the occurrence of sediment inputs that could accumulate with the fire event and exacerbate negative impacts to the waters and aquatic covered species. As required by the watershed analysis process, the Wildlife Agencies shall establish the site-specific prescriptions for implementation upon the completion of the watershed analysis. Ongoing Covered Activities may continue to utilize the existing Aquatic Conservation Plan measures until the new prescriptions are developed. However, as the Wildlife Agencies deem necessary, in consultation with PALCO, measures will be promptly implemented to minimize adverse effects prior to completion of the watershed analysis.

Fire Unforeseen Circumstances

Any fire as described above that covers more than 5000 total acres.

B. THE ROLE AND EFFECTS OF WIND

Windstorms can be a major process in the coastal forests of the Pacific Northwest (Agee and Edmonds 1992; Henderson et al. 1989). Once away from the coast, windstorms are not as regionally important, although limited areas of blown-down and damage along stand edges does occur.

In the Sitka Spruce Zone, windthrow may be the primary disturbance factor acting on the forest, as opposed to fire in drier, more inland areas (Agee and Edmonds 1992). This importance is identified for this zone from Oregon north through southeast Alaska, where large-scale windthrow events are likely to occur several times each century. Generally, the same area is not affected by each storm. Local topography affects the pattern and severity of windthrow. On PALCO lands, wind-fallen trees are a common, but localized, occurrence. Windthrow in riparian leave strips or buffers occurs and is expected in the future but such windthrow is almost always limited to individual trees or groups of trees. Small-scale windthrow is windthrow which causes less impact than the complete blowdown of 200 feet, measured along the length of the stream, of trees within the riparian zone of Class I and Class II streams. This small-scale windthrow is a normal and expected part of the forest ecology and was contemplated when the mitigation measures for this Plan were designed. Small-scale windthrow is not expected to have a significant adverse impact on stream shading or water temperatures and will have the beneficial effect of introducing large woody debris into streams that currently lack this habitat forming element. Thus, small-scale windthrow does not pose so substantial an impact as to threaten an adverse change in the status of any covered species, and may actually benefit aquatic species (Lisle 1998, in press).

Windthrow Changed Circumstances

A windstorm which results in the complete blowdown of between 200 ft. and 500 ft., measured along the length of the waters, of the trees within the RMZ of any Class I or Class II waters is a Changed Circumstance.

In order to mitigate the impact of such changed circumstance windthrow on aquatic species, PALCO, in cooperation and consultation with the Wildlife Agencies, will conduct an expedited watershed analysis on the hydrologic unit impacted by any changed circumstance windthrow.

The analysis will be commenced as soon as the requisite personnel from PALCO and the Wildlife Agencies required for the analysis can be made available. If watershed analysis has been performed previously for such hydrologic unit , then the affected area will be revisited. If the area has not been previously analyzed prior to the changed circumstance, then it will be made a priority for analysis.

If multiple windthrow changed circumstances sufficiently close to each other in time such that the response will be significantly delayed due to lack of available personnel, PALCO will confer with the Wildlife Agencies in order to prioritize the analyses which need to conducted as a result of the changed circumstance.

The outcome of watershed analysis will be the development of appropriate measures to minimize, to the extent practicable, the occurrence of sediment inputs that could accumulate with the fire event and exacerbate negative impacts to the waters and aquatic covered species. As required by the watershed analysis process, the Wildlife Agencies shall establish the site-specific prescriptions for implementation upon the completion of the watershed analysis. Ongoing Covered Activities may continue to utilize the existing Aquatic Conservation Plan measures until the new prescriptions are developed. However, as the Wildlife Agencies deem necessary, in consultation with PALCO, measures will be promptly implemented to minimize adverse effects prior to completion of the watershed analysis.

Windthrow Unforeseen Circumstances

A windstorm which results in the complete blowdown of more than 500 ft., measured along the waters, of trees within the RMZ of any Class I or Class II waters is an Unforeseen Circumstance.

C. THE ROLE AND EFFECTS OF LANDSLIDES

Landslides are known to have local and often significant impacts on plant communities (e.g., Brown 1985). Depending upon their severity and scale, landslides can open up areas within otherwise continuous and closed forests for new reproduction. In addition, landslides are an important source of gravels and cobbles in streams. Evidence of landslides is observed more often in areas of high topographic relief with unstable surface soil profiles.

Within the area of the coast redwood forest of northern California, the effects of landslides in creating gaps for new reproduction are of greater significance than in other forest areas more subject to stand/forest replacing catastrophic events. Within the coast redwood forests, landslides are of relatively frequent occurrence, on the scale of decades. Landslides may have the potential to eliminate small patches of wildlife habitat, but these events are both impossible to predict and unlikely to have a cumulatively significant effect upon terrestrial species, given their wide distribution over the landscape and limited individual scale. By contrast, landslides, depending on their magnitude can have a significant negative effect on aquatic invertebrates and fish.

Accordingly, conservation and mitigation measures for aquatic species within this plan were designed both to address sediment and other habitat effects from past landslides and, through a comprehensive series of stream buffer prescriptions, land management restrictions, geologic surveys, and sediment monitoring, to avoid significant adverse impacts from management induced landslide and mass wasting events in the future. Landslides which cause significant alteration of the in-stream habitat condition to less than 10% of the total length of all Class I and Class II streams in any planning watershed are part of the ordinary ecology of the forest and are adequately addressed by the existing conservation and mitigation measures.

Landslide Changed Circumstances

A landslide or landslides that cause, or are substantially likely to cause, alteration of 10 percent or more of the instream condition in any one Class I water, and a landslide or landslides that cause, or are substantially likely to cause, alteration of 10 percent or more of the instream condition of the total length of all Class II waters in a planning watershed constitutes a Changed Circumstance for the planning watershed or watersheds where the landslide(s) occurred up to the level at which the landslide(s) become an Unforeseeable Circumstance.

In order to mitigate the impact of such changed circumstance landslide(s) on aquatic species, PALCO, in cooperation and consultation with the Wildlife Agencies, will conduct an expedited watershed analysis on the hydrologic unit impacted by any changed circumstance landslide(s).

The analysis will be commenced as soon as the requisite personnel from PALCO and the Wildlife Agencies required for the analysis can be made available. If watershed analysis has been performed previously for such hydrologic unit , then the affected area will be revisited. If the area has not been previously analyzed prior to the changed circumstance, then it will be made a priority for analysis.

If multiple landslide(s) changed circumstances sufficiently close to each other in time such that the response will be significantly delayed due to lack of available personnel, PALCO will confer with the Wildlife Agencies in order to prioritize the analyses which need to conducted as a result of the changed circumstance.

The outcome of watershed analysis will be the development of appropriate measures to minimize, to the extent practicable, the occurrence of sediment inputs that could accumulate with the

landslide event and exacerbate negative impacts to the waters and aquatic covered species. As required by the watershed analysis process, the Wildlife Agencies shall establish the site-specific prescriptions for implementation upon the completion of the watershed analysis. Ongoing Covered Activities may continue to utilize the existing Aquatic Conservation Plan measures until the new prescriptions are developed. However, as the Wildlife Agencies deem necessary, in consultation with PALCO, measures will be promptly implemented to minimize adverse effects prior to completion of the watershed analysis.

Landslide Unforeseen Circumstances

A landslide or landslides that cause, or is likely to cause, alteration of 80 percent or greater of the instream condition in any one Class I water in a planning watershed, and a landslide or landslides that cause or are substantially likely to cause, alteration of 80 percent or more of the instream condition of the total length of all Class II waters in a planning watershed.

D. THE ROLE AND EFFECTS OF FLOODS

Although the impacts on forests from flooding are generally recognized (Brown 1985), the effects are apparently localized. Because most streams on PALCO's lands are partially or totally contained (i.e., flow through narrow river valleys) the total area exposed to potential flooding is limited. The experience of observing large trees floating in flood stage rivers and the changing of river courses confirms that flooding does often remove, at least locally, trees or stands of trees. However, flooding is a natural and necessary component of stream ecosystems. For example, floods transport and sort sediment, carry fine sediments and nutrient onto flood plains, clean spawning substrates of silts and sands, and produce scour that leads to the development of pools and other habitat. Changing river courses also periodically provides opportunities for the establishment of new stands of trees within the coastal areas of California, Oregon, and Washington.

Within the Coastal Redwood Zone of northern California, flooding is important for providing opportunities for the establishment of new Redwood stands (Franklin and Dyrness 1973). The rich alluvial terraces along river courses provide ideal growing conditions for coast redwoods, evident in the high quality old-growth stands present in many river-bottom areas. Although many such stands persist for hundreds of years, all are subject to partial or complete elimination during major flood events. In fact, rather than a concern for elimination of habitat values, these processes are seen as habitat *enhancing* for many species -- i.e., the recruitment of large woody debris into riverine systems for salmonid habitat structure and improved watercourse morphology, etc. The aquatics component of the HCP recognizes the dynamic nature of stream courses and already accounts for effects of flood by, for example, significantly restricting harvest adjacent to Class I and II streams and thus allowing for natural processes to mitigate the effects of flooding. A central component of the aquatics strategy is a watershed assessment process which will result in watershed-by-watershed prescriptions on activities adjacent to stream courses and reflecting the specific geomorphology of each watershed. Thus, the watershed assessment will result in specific prescriptions in those watersheds. For example, watershed analysis will identify road segments

and hill slopes at high probability of delivering sediment to streams, and will identify management mitigations to address these problems.

Floods which are less in magnitude than a 50-year recurrence interval event (i.e., less that a 50-year flood) are part of the expected normal ecology of the forest. The mitigation and conservation measures in the Plan, as described in this paragraph, are adequate mitigation for such floods.

Flood Changed Circumstances

A 50-year to 100-year recurrence interval flood events constitute changed circumstances. In order to mitigate the impact of such changed circumstance floods on aquatic species, PALCO, in cooperation and consultation with the Wildlife Agencies, will conduct an expedited watershed analysis on the hydrologic unit impacted by any changed circumstance floods.

The analysis will be commenced as soon as the requisite personnel from PALCO and the Wildlife Agencies required for the analysis can be made available. If watershed analysis has been performed previously for such hydrologic unit , then the affected area will be revisited. If the area has not been previously analyzed prior to the changed circumstance, then it will be made a priority for analysis.

If multiple flood changed circumstances sufficiently close to each other in time such that the response will be significantly delayed due to lack of available personnel, PALCO will confer with the Wildlife Agencies in order to prioritize the analyses which need to conducted as a result of the changed circumstance.

The outcome of watershed analysis will be the development of appropriate measures to minimize, to the extent practicable, the occurrence of sediment inputs that could accumulate with the fire event and exacerbate negative impacts to the waters and aquatic covered species. As required by the watershed analysis process, the Wildlife Agencies shall establish the site-specific prescriptions for implementation upon the completion of the watershed analysis. Ongoing Covered Activities may continue to utilize the existing Aquatic Conservation Plan measures until the new prescriptions are developed. However, as the Wildlife Agencies deem necessary, in consultation with PALCO, measures will be promptly implemented to minimize adverse effects prior to completion of the watershed analysis.

Flood Unforeseen Circumstances

A flood which is greater in magnitude than a 100-year recurrence interval flood event is an Unforeseen Circumstance.

E. THE ROLE AND EFFECTS OF EARTHQUAKE

The region in which PALCO's lands are located lies in an area known for frequent, but generally small, earthquakes. The San Andreas fault passes within 50 miles offshore of most of the Company's lands, and several smaller, less-significant faults are found throughout the region. Because earthquakes are quite common, they are generally of a relatively insignificant magnitude, on average of approximately Richter scale magnitude 2. Occasionally, more significant events occur, but of course, they are impossible to predict. For example, in April of 1992 three earthquakes of magnitude 6 or greater on the Richter scale occurred in relatively short succession. These earthquakes produced ground shaking of sufficient magnitude to sever a gas line, resulting in a fire which destroyed the Scotia Shopping Center near PALCO's headquarters and offices. However, in the forest environment, even these earthquakes -- perhaps the most significant clustered events in recorded history -- produced little if any visible change, and apparently no significant impact to wildlife or fishery habitat. No stand of trees of any age is known to have been downed as a result of the April 1992 earthquake, or any other recorded earthquake event. While, it may be speculated that localized landslides or other earth movements resulted from the earthquake, there is no data to document that this occurred on PL's lands.

Earthquake-caused landslides, if any, would occur in areas of high topographic relief and with unstable surface soil profiles. These areas are already mapped, and are subject to numerous mitigations, other management measures and restrictions as provided in this plan to prevent or minimize their occurrence, and if they do occur, to minimize their impact. While the connection has never been made on PALCO lands, it is also possible that some trees have fallen as a result of earthquake activity. Fallen trees located in the forest are generally attributed to windthrow effects, and in the aggregate, from whatever cause, fallen trees are not of so significant a number or volume as to require additional mitigations and/or changes in the management scenario or restrictions outlined in this plan.

Landslides caused by earthquakes will be addressed pursuant to the "Landslide" subsection of this Changed Circumstances section. Earthquakes of such significant magnitude as may substantially alter habitat status or require additional conservation or mitigation measures other than responding to landslides caused by such earthquake are not reasonably foreseeable during the life of the HCP.

F. THE ROLE AND EFFECTS OF EL NINO AND OIL SPILLS

The murrelet, one of the focus species of this Plan, is a seabird. The coho salmon, chinook salmon, and other fish species covered by this Plan are anadromous. Obviously the conditions at sea, where these species spends much of their lives, are of importance in any evaluation of potential habitat changes. The ocean offshore of the Company timberlands serves, as well, as habitat for many invertebrates and fish which may be prey sources for murrelets and raptors or are otherwise covered under the Plan. Humboldt Bay National Wildlife Refuge was established in 1989 in recognition of the area’s unique fish and wildlife values.

The risk of an oil spill incident in the area is probably greatest in developed ports. For example, Humboldt Bay has been identified as a "facility transfer area" by the CDFG division of Oil Spill Prevention and Response. (Statewide Coastal Protection Review, report to Calif. Legislature 1995.) Millions of gallons of fuel are delivered into Humboldt Bay annually in as many as 60 deliveries each year. (Id.)

Nonetheless, despite the potential risk for large oil spills, historically, most spills have been small. The average spill volume has been calculated to be 77 gallons, or 1.8 bbls. In one study by DFG, most spills were reported to be in the 5 to 25 gallon range during the period from 1984 through 1991, the last period for which figures could be obtained. (Id.)

While such events may be reasonably foreseeable -- inasmuch as over the same 7-year period as many as 150 spill incidents of some sort were documented -- most such events were not of the sort which would result in substantial adverse change, or indeed in any measurable change, in the status of the species covered under this plan. One significant spill in Humboldt Bay in November 1997 is thought to have killed 11 murrelets, but this effect does not argue for additional timberland mitigation provisions, for example, where adult birds' reproductive habitat availability could be considered proportionally increased by such mortality effects: fewer birds in an area, from effects other than habitat limitations, translates to greater nesting opportunities for remaining adults. No additional changes to the mitigation or conservation measures in this Plan are required to respond to oil spills. An oil spill of sufficient magnitude to cause so significant adverse impacts to the murrelet or any other covered species that additional conservation or mitigation measures are required is an unforeseen circumstance.

El Nino, the warm water current that flows across the South Pacific and causes temperature and rainfall changes throughout the Pacific Northwest is a Changed Circumstance. However, the Plan was developed during an El Nino event. Thus this Plan contains all mitigation necessary to respond to another El Nino event of the same magnitude as occurred in 1997-1998. An El Nino event of greater magnitude than occurred in 1997-1998 is an unforeseen circumstance.

III. LEGAL CHANGED CIRCUMSTANCES AND UNFORESEEN CIRCUMSTANCES

A. NEW LISTING OF SPECIES NOT COVERED UNDER FEDERAL OR STATE PERMIT

The preamble to the No Surprises rule states that the listing of a species as endangered or threatened may constitute a changed circumstance.

The Wildlife Agencies shall immediately notify PALCO upon becoming aware that a species which is associated with habitat found on the Covered Lands and which is not a Covered Species (a "Uncovered Species") may be or has been proposed for listing.

Upon receipt of notice of the potential listing of an Uncovered Species, PALCO may, but is not required, to enter into negotiations with the Wildlife Agencies regarding necessary modifications, if any, to the Plan required to amend the applicable Federal Permit and/or State Permit to cover the Uncovered Species. If PALCO elects to pursue amendment of the applicable Permit, the Wildlife Agencies will provide technical assistance to PALCO in identifying any modifications to the Plan that may be necessary to amend the applicable Federal Permit or State Permit.

In determining whether any further conservation or mitigation measures are required in order to amend the affected Permit to authorize Incidental Take of such Uncovered Species, the Agencies shall take into account the conservation and mitigation measures already provided in the Plan and cooperate with PALCO to minimize the adverse effects of the listing of such Uncovered Species on the Covered Activities consistent with Section 10 of the FESA or CESA, as required by section 6.1.5(b) of the Implementation Agreement.

Once a "may be warranted" finding is made by the applicable Service or the Fish and Game Commission, the applicable Wildlife Agency shall use its best efforts to identify any necessary measures to avoid the likelihood of jeopardy to or take of (the "no take/no jeopardy measures") the Uncovered Species. The measures shall be developed in consultation with PALCO.

If PALCO and the applicable Wildlife Agency cannot come to agreement on the "no take/no jeopardy" measures, PALCO may invoke the alternative dispute resolution process set forth in section 9.2 of the Implementation Agreement.

If the applicable Federal and/or State Permit has not been amended to include the Uncovered Species at the time the species is listed, then PALCO shall implement the "no take/no jeopardy" measures identified by the Agencies until the applicable Permit is amended to include the Uncovered Species or the Wildlife Agencies notify PALCO that such measures are no longer needed to avoid the likelihood of jeopardy to, take of, or adverse modification of the designated critical habitat, if any, of the Uncovered Species.

B. Changed Circumstances To Address Suspension, Revocation or Relinquishment of Either the NMFS or USUSFWS Federal Permit.

If either the USUSFWS or the NMFS Federal Permit is suspended, revoked or relinquished in accordance with the procedures in the Implementation Agreement, the Wildlife Agencies will re-evaluate the remaining Federal Permit to insure that continuation of one or more of the Covered Activities is not likely to jeopardize, take, or adversely modify the critical habitat, if any, of the Covered Species listed under the FESA and included on the suspended, revoked or relinquished permit (the "Affected Covered Species"). The applicable Wildlife Agencies will identify any modifications to the Covered Activities in consultation with PALCO necessary to avoid Take and/or jeopardy to the Affected Covered Species. If PALCO disagrees with the modifications to Covered Activities identified by the Wildlife Agencies, PALCO may invoke the dispute resolution

process provided under Section 9.2 of the Implementation Agreement without waiving its right to seek judicial review of any applicable agency decision. PALCO shall implement any identified modifications to the Covered Activities until USFWS or NMFS notifies PALCO in writing that modifications to the Plan Covered Activities are no longer required to avoid the likelihood of jeopardy to, take of, or adverse modification of the designated critical habitat, if any, of the Affected Covered Species, the suspended Federal Permit is reinstated, or PALCO applies for and is issued a new FESA section 10(a)(1)(B) permit covering the Affected Covered Species. Any modification required by the Wildlife Agencies shall to the maximum extent feasible minimize impacts to Covered Activities consistent with this Plan and the Implementation Agreement.

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